DOCUMENT RESUME

ED 425 563 EC 306 572

AUTHOR	Searls, Evelyn F.
TITLE	How To Detect Reading/Learning Disabilities Using the WISC-III.
INSTITUTION	International Reading Association, Newark, DE.
ISBN	ISBN-0-87207-186-3
PUB DATE	1997-00-00
NOTE	93p.
AVAILABLE FROM	International Reading Association, 800 Barksdale Road, P.O. Box 8139, Newark, DE 19714-8139.
PUB TYPE	Books (010) -- Guides - Non-Classroom (055)
EDRS PRICE	MF01/PC04 Plus Postage.
DESCRIPTORS	Disability Identification; Elementary Secondary Education; *Intelligence Tests; *Learning Disabilities; *Reading Difficulties; *Student Evaluation; *Test Content; *Test Interpretation; Test Reliability
IDENTIFIERS	*Wechsler Intelligence Scale for Children III

ABSTRACT

This monograph describes the third edition of the Wechsler Intelligence Scale for Children (WISC-III) and its relationship to reading/learning disabilities. It is designed for educators and students in education who want to go beyond the numerical values of the WISC-III intelligence quotients and understand the implications of the scores for the assessment and instruction of individual students. Chapter 1 discusses the use of intelligence tests and the WISC-III. The organization and administration of the WISC-III are addressed in Chapter 2. Chapter 3 describes each subtest as to the task involved, what purportedly is being measured, method of scoring, possible implications of high and low scores, and suggested relationships to reading. Chapter 4 presents procedures for analyzing WISC-III scores as a means of generating hypotheses about students' cognitive strengths and weaknesses that may affect reading ability. The final chapter discusses the research base by providing an overview of the research literature on the WISC series and reading/learning disabilities. Appendices include a WISC-III record form, a WISC-III data sheet, and an evaluation form that includes abilities measured by two or more WISC-III subtests. (Contains 74 references.) (CR)

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How to Detect Reading/Learning Disabilities Using the WISC-III

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How to Detect Reading/Learning Disabilities Using the WISC-III

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Library of Congress Cataloging in Publication Data

Searls, Evelyn F.
How to detect reading/learning disabilities using the WISC-III / Evelyn F. Searls.
p. cm.
Rev. ed. of: How to use WISC-R scores in reading/learning disability diagnosis. c1985.
Includes bibliographical references.
ISBN 0-87207-186-5 (pbk.)
1. Reading–Ability testing. 2. Learning disabled children–Psychological testing. 3. Wechsler Intelligence Scale for Children. I. Searls, Evelyn F. How to use WISC-R scores in reading/learning disability diagnosis. II. International Reading Association. III. Title.
[DNLM: 1. Learning Disorders–diagnosis. 2. Reading Disorders–diagnosis. 3. Wechsler Scales. WS 105.5.A6 S42 1997] 97-42655
372.48–dc21 CIP

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Preface

The first edition of this monograph was published in 1975 under the title, *How to Use WISC Scores in Reading Diagnosis*. It was based on the Wechsler Intelligence Scale for Children (WISC), published in 1949, and on the wealth of clinical and research data that had accrued through the use of the WISC for 25 years, particularly as the data pertained to children with reading disabilities.

Shortly before the publication of the original monograph, the revised edition of the WISC (WISC-R) was published in 1974. In the following decade numerous reports appeared in the literature on the use of the WISC-R with children with reading/learning disabilities. To a great extent these reports stemmed from work in the field of specific learning disabilities. Therefore, in 1985 the original monograph was revised to describe the WISC-R and what it measured with regard to reading/learning disabilities in light of the accumulated findings, and the title was changed to *How to Use WISC-R Scores in Reading/Learning Disability Diagnosis*. In addition, a chapter that gave a fuller treatment of research findings was added.

In 1991 the third edition of the Wechsler Intelligence Scale for Children (WISC-III) was published. Accordingly, the International Reading Association asked me to update this monograph by describing the WISC-III and its relationship to reading/learning disabilities and by including the most recent research. The format is very similar to the second version except that the short chapter on other Wechsler Scales has been omitted. This revision was written primarily for the use of educators [classroom teachers, reading teachers, and teachers of students with specific learning disabilities (SLD)] and for undergraduate and graduate students in education who want to go beyond the numerical values of the WISC-III intelligence quotients (IQs) and understand the implications of the scores for the assessment and instruction of individual students. The title of this third revision focuses the reader on the central idea of the monograph—that teachers should use clues gained from

their knowledge of the reading process, of students, and of the abilities measured by the WISC–III to generate hypotheses as to individuals' cognitive strengths and weaknesses that may be involved in their reading/learning disabilities.

I wish to thank The Psychological Corporation for providing examples of the types of questions and tasks similar to those found on the WISC–III so that the security of the test is not violated, as it would be if actual test items were used. As pointed out in Chapter 1, the WISC–III is a classified psychological test, and its use is limited to personnel who have had extensive training in its administration and interpretation. Furthermore, *Standards for Educational and Psychological Testing* (American Psychological Association, 1985) emphasizes that those who receive reports of test scores should be instructed in appropriate methods for interpreting them. This monograph provides information to help teachers interpret the WISC–III scores of their students; however, because of the complexities involved in psychological testing, I encourage teachers who use this monograph to consult with their school psychologist for further clarification of details not covered in this publication.

In the writing of even so brief a volume as this, there are those persons whose help made the task easier. I want to express my appreciation to Joan M. Irwin, Director of Publications, International Reading Association, for her encouragement of this revision; Wendy Lapham Russ, Assistant Director of Publications, for her assistance with technical matters; and Janet S. Parrack, Assistant Editor, Books, for her helpful suggestions and attention to editorial details. Finally, I want to thank my husband, V.M. Searls, a retired airline pilot and nontypist, who taught himself to use a word processor and produced an error free manuscript (well, almost!) for the second version of this monograph and now has repeated his good work for this revision.

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CHAPTER 1

The Individual IQ Test and Reading/Learning Disabilities

Overheard in the teachers' lounge: "I just got back the psychologist's report on Bill. It says he has average intelligence. If that's so, why on earth can't he read?"

Intelligence is a necessary prerequisite to the act of reading. Generally speaking, superior intelligence produces superior readers and borderline intelligence, poor readers. There are numerous exceptions to this generalization, however, particularly in the average range of intelligence. Investigators have found disabled readers and even nonreaders to have average or above average intelligence as measured on standardized intelligence tests.

Intelligence tests are used to help determine the presence of a reading/learning disability. Jim, a sixth-grade student reading at fourth-grade level, may not be a disabled reader. On the other hand, his classmate, Carol, who reads at grade level, may have a reading disability. Unless we have some way to determine whether there is a discrepancy between achievement level and intellectual capacity, we cannot say that a reading disability may exist (Harris & Sipay, 1985). To ascertain this discrepancy, reading specialists have long advocated the use of an individually administered IQ test, because group IQ tests, requiring silent reading with good comprehension and often under timed conditions, may penalize poor readers. Furthermore, with the passage of the U.S. Education for All Handicapped Children Act (PL 94-142) in 1975, an individual IQ test

was federally mandated in the assessment of students suspected of having specific learning disabilities.

The most widely used, individually administered IQ test is the Wechsler Intelligence Scale for Children (Kamphaus, 1993), now in its third edition and known as WISC–III. It must be administered by trained personnel, usually a school psychologist, and yields a global IQ that indicates a level of intellectual functioning based on how the student performed on certain tasks. The WISC–III is best characterized as a test that gathers samples of behavior under fixed conditions, is a measure of an individual's past accomplishments, and is predictive of success in traditional school subjects (Kaufman, 1994; Wesman, 1968).

In addition to a global IQ, the WISC–III indicates how a student performs on verbal tasks, performance tasks, and on each separate subtest task. For this reason the WISC–III (and its predecessors, the WISC and the WISC–R) has been useful in the assessment of reading/learning disabilities. Faced with the fact that disabled readers/learners often had global IQs in the average range or above, investigators began to observe how they scored on different tasks presented by the subtests. Summaries of research by Strang (1968), Farr (1969), Huelsman (1970), Sattler (1988), and Kaufman (1994) indicate two rather consistent findings: (a) Groups of students with reading/learning disabilities tend to score higher on the Performance Scale than on the Verbal Scale, and (b) they tend to score lower on certain subtests.

Since almost all the research has been ex post facto (after students have been identified as having reading/learning problems), the issue of cause and effect is still debatable. Were the students inherently inadequate in certain aspects of intelligence (as tapped by the subtests on which they scored low), or had they failed to develop in these areas because of their lack of reading/learning ability? Farr (1969) concluded from his review of the research that reading disability "negatively affects performance on intelligence tests" (p. 186).

Whether this conclusion is accepted, it becomes apparent that the global score (the WISC–III Full Scale IQ), particularly if it falls within the average range or above (according to

Wechsler's classification), is probably the least important piece of information the test yields for the teacher working with the student on a daily basis. It tells the teacher that, as measured by a standardized IQ test, the student has the necessary mental abilities to learn to read; it does not give any clues as to why the student is having difficulties with the task. Often, only the Full Scale IQ is reported to the teacher, along with comments and recommendations by the examiner. Even if the Verbal IQ, Performance IQ, and subtest scores are reported, these may have little meaning for teachers unfamiliar with the WISC–III.

Because the WISC–III is a classified psychological test, its use is limited to personnel who have had extensive training in its administration and interpretation. This restriction is necessary in order to preserve the validity of the test. It has, however, tended to shroud the measurement of intelligence with an air of mystery because teachers cannot examine the test for themselves. If teachers are to make maximum use of WISC–III test results as they try to remediate students' reading/learning disabilities, they need to be knowledgeable about the test, the samples of behavior it measures, and the implications of the scores for instructional planning.

The purpose of this monograph is to provide such knowledge for educators who are responsible for the planning and implementation of reading remediation. The organization and administration of the WISC–III are discussed in Chapter 2. Chapter 3 describes each subtest as to the task involved, what purportedly is being measured, method of scoring, possible implications of high and low scores, and suggested relationships to reading. Chapter 4 presents procedures for analyzing WISC–III scores as a means of generating hypotheses about students' cognitive strengths and weaknesses that may affect reading ability. Finally, for those readers who wish to delve more deeply into the research base, Chapter 5 provides an overview of the research literature on the WISC series and reading/learning disabilities.

CHAPTER 2

The WISC-III

Standardizing and Norming

The WISC-III was standardized on a sample of 100 boys and 100 girls at each of 11 age levels (6 years 6 months to 16 years 6 months), a total of 2,200 children. The sample was selected to be representative of the United States population (according to the 1988 Census survey) on the variables of age, sex, race–ethnicity, geographic region, and level of parent education. The standardization sample included students in both public and private school settings and, for the first time, students receiving special services in school settings. Thus, 7% of the children tested were classified as learning disabled, speech–language impaired, emotionally disturbed, physically impaired, or were in Chapter 1 (remedial) programs. In addition, 3% were in gifted and talented programs. Children were tested only if they could speak and understand English (Wechsler, 1991).

Developing new norms was the principal goal of the WISC-III because norms for intelligence tests become dated over time. Research by Flynn (1984, 1987) has shown that "People in technologically advanced nations do better on intelligence tests as time goes by; when compared with other people of the same age who were tested 5, 10, 20, or 30 years previously, today's children and adults answer more verbal questions right and solve more nonverbal problems correctly" (Kaufman, 1994, p. 37). Researchers have not yet identified the reasons for this. However, a number of causative factors have been proposed: the impact of television, emphasis on the early

stimulation of young children, better educated parents, and improved nutrition (Kaufman, 1979, 1994). Sternberg (1997) has made a strong case for the effects of advances in technology on the gains in IQ scores. For example, the use of programmable calculators has developed logical thinking and conceptual and problem-solving abilities. Electronic communication has made it possible for children "to experience events and even virtual worlds that were never available to their parents when they were children" (Sternberg, 1997, p. 14), thus increasing their store of knowledge. Computer games have helped develop rapid thinking and spatial and perceptual-motor skills. These are all skills and abilities that are measured on intelligence tests.

Whatever the reasons for the rise in IQ scores, what this means in practice is that "when a child's performance is referenced to an outdated standardization sample, rather than to a contemporary sample, the IQ score will be inflated" (Wechsler, 1991, p. 197). When the WISC-R (normed in 1972) and the WISC-III (normed in 1990) were administered to the same sample of 206 children, the score inflation was demonstrated; the mean WISC-R Full Scale IQ was approximately 5 points higher, and the mean Verbal and Performance Scale IQs were 2 and 7 points higher than the corresponding WISC-III scores (Wechsler, 1991). Similar differences had been found in 1974 between the WISC and WISC-R, which were 25 years apart. To counteract the effect of score inflation, new norms must be developed so that a score of 100 on any of the three scales will continue to define the performance of the average child of a given age compared with his or her contemporaries (Wechsler, 1991). Persons responsible for the identification of students with reading/learning disabilities should be aware of the score inflation phenomenon, should insist on the choice of the WISC-III for inclusion in a multitest battery, and should expect lower scores than those made on the WISC-R if students were previously tested with that instrument.

A major change in the WISC-III from its predecessors is the addition of a new subtest, Symbol Search. This is the first change in the subtest array since the WISC was first published and one that promises to be of special interest to readers of this monograph. Other changes were made in subtest content

(adding new items and modifying or replacing subtest items considered to be outdated, ambiguous, or unfair to particular groups) and in administration and scoring procedures. However, a major goal of the test revision was to maintain the basic structure and content of the WISC and WISC-R because of the wealth of clinical and research data that have accrued through their widespread use over a 40-year period. Therefore, the organization of the test and the abilities it measures remain essentially unchanged (Wechsler, 1991).

Organization

The WISC-III is divided into two parts, a Verbal Scale and a Performance Scale, each having five subtests required for computation of the IQs and one subtest usable as a supplement or a substitute (if one of the required tests is invalidated or cannot be given). In addition, the Performance Scale has a second supplementary subtest that can substitute only for Coding.

Verbal Scale

1. Information
2. Similarities
3. Arithmetic (timed)
4. Vocabulary
5. Comprehension
6. Digit Span (supplement or alternate)

Performance Scale (all timed)

7. Picture Completion
8. Coding
9. Picture Arrangement
10. Block Design
11. Object Assembly
12. Symbol Search (supplement; alternate only for Coding)
13. Mazes (supplement or alternate; seldom used)

It is helpful to think of these two scales in terms of input and output, and not as measuring different kinds of intelligence (Wechsler, 1991). The Verbal Scale involves auditory verbal input and vocal verbal output. The examiner reads aloud

the questions on all subtests; the student responds orally. The Performance Scale involves visual, nonverbal input and motor, nonverbal output. Although the examiner gives brief verbal instructions for each task, the students receive visually and nonverbally the information necessary for them to perform the task, and no verbalization is necessary for the motor responses.

It also should be noted that the Verbal subtests are all untimed with the exception of Arithmetic; conversely, the Performance subtests are all timed. The Arithmetic subtest and the Performance subtests present problem-solving situations. Ideally, the student works rapidly, quickly sizing up the problem and starting to solve it. Bonus points given for speed of responses on the Arithmetic subtest and on four of the Performance subtests can increase the student's subtest scores considerably. Therefore, timing is important on these subtests. Kaufman (1994) points out that on the WISC-III, even more so than on the WISC-R, "children who have difficulty working within time limits, or who become extremely anxious when face to face with a stopwatch, will be extremely penalized on the Performance Scale" (p. 191).

Ten of the 13 subtests begin with easy items, become progressively more difficult, and are discontinued after a specified number of failed items. The three exceptions are Object Assembly, Coding, and Symbol Search on the Performance Scale. Object Assembly moves from easy to difficult, but all five puzzles must be attempted by the subject. Coding and Symbol Search each have two parts—one intended for subjects under the age of 8 and the other for subjects age 8 or older. The subject must try to complete the appropriate part within the time limit. Chapter 3 describes each subtest in detail and explains scoring procedures.

Administration

The WISC-III is administered by a trained examiner on an individual basis to children ages 6 years 0 months to 16 years 11 months. The testing should be carried out in a quiet setting, free from distractions, and only after good rapport has

been established between the examiner and the testee. It is very important for the examiner in a school setting to be known and accepted by the children to be tested and by others in their group. This may require the examiner to spend some time in the classroom getting acquainted, observing the child in the classroom situation, and establishing a friendly relationship with the teacher.

Beginning with the Picture Completion subtest, the 10 required Verbal and Performance subtests are administered in alternating order to make the testing session more interesting and varied. If the examiner decides to include Digit Span, Symbol Search, or Mazes, either as alternates or supplements, they are administered at the end of the required battery.

Digit Span and Mazes may be used as alternates only if the score on any one of the other subtests on their respective scales has been invalidated in some way (such as an error in administration, an external interference during testing, or an unexpected emotional blocking by the testee). Symbol Search may be used as an alternate only for Coding. When these three subtests are used as alternates, the scores are included in the computation of the IQs.

Digit Span, Symbol Search, and Mazes always may be used as supplements, and Wechsler recommends their inclusion whenever possible because of the qualitative and diagnostic data they provide. However, when they are used as supplements, the scores are not included in the IQ computation.

The examiner follows explicit directions in the test manual as to what to say and do in administering the WISC-III, records all verbal responses exactly as given, and uses a stopwatch for the timed tests. Administration time may vary from 50 to 75 minutes, depending on the age of the child and the degree of elaboration of verbal responses.

Reporting of Scores

Scores are recorded on the front summary page of the WISC-III Record Form. If you have access to this page for a child with whom you have worked, you may want to look at

the scores as they are discussed here and in Chapter 3. (Otherwise, see Appendix A.)

The WISC–III yields four types of scores: Full Scale IQ, Verbal and Performance Scale IQs, factor indexes, and subtest scores. Wechsler (1991) uses the following terminology to classify IQs and indexes within the specified numerical ranges:

130–and above	Very superior
120–129	Superior
110–119	High average
90–109	Average
80–89	Low average
70–79	Borderline
69–and below	Intellectually deficient

Full Scale IQ

The Full Scale IQ, if within the Average range or above, is probably the least valuable score for a teacher. At best, it provides a good summary score of a child's performance in 10 to 12 samples of behavior only if his or her Full, Verbal, and Performance Scale IQs are fairly similar, and there are no significant fluctuations in subtest scores (Kaufman, 1994). At worst, it is overemphasized as a single score that represents and labels a child's total intellectual functioning.

Deemphasizing the Full Scale IQ is also important because it is not the child's "true" score. All measurement is approximate. The more exact the measuring instrument, the less variation occurs. Unfortunately, the instruments for measuring intelligence are not exact, especially compared to those available for physical measurements. Therefore, when we consider a test score, we must take into account the margin of error. This margin of error is known as the standard error of measurement. Suppose you repeat a certain test measurement 100 times and take the average of all the scores. That average can be thought of as the true score. Obviously, you cannot administer the same test 100 times in the school situation in order to learn the true score of the person being tested.

Therefore, you need something that will give you an idea of how far away from the true score a single score may be. The standard error of measurement can be statistically computed for any test and used to establish confidence intervals, that is, a range of scores in which the child's true score is likely to fall. The WISC–III manual provides 90% and 95% confidence intervals for the IQs and indexes. For example, a Full Scale IQ of 100 has a 90% confidence level range of scores from 93–105 and a 95% confidence level range of 94–106. The examiner chooses the percent of confidence and reports it and the accompanying range of scores on the front summary page of the WISC–III Record Form. If the examiner chooses 90%, we can be confident that the child's true score, 9 times out of 10, will fall between 93 and 105. If the choice is 95%, we can be confident that the true score, 19 times out of 20, will fall between 94 and 106.

The fact that the WISC–III Record Form now includes space for reporting a range of scores should help to deemphasize the use of a single score. Even if teachers do not receive this information, they can estimate the range because the confidence intervals for the Full Scale IQ across all age levels are approximately 3 IQ points for 90% confidence and approximately 6 IQ points for 95% confidence (Kaufman, 1994).

Verbal and Performance Scale IQs

The Verbal and Performance Scale IQs, like the Full Scale IQ, contain a certain amount of error in measurement. Thus, the examiner will choose 90% or 95% confidence intervals and band the IQs with a range of scores (provided by the WISC–III manual) within which the true score will fall.

The value of examining the Verbal and Performance Scale IQs lies in the magnitude of the difference between them. Here the comparison is between how the students function on verbal tasks as opposed to how they function on performance tasks. A large difference (11 or more points) may indicate deficiencies in ways of processing information, in modes of expression, or in working under timed conditions, all of which

also may be involved in reading/learning disabilities. This will be discussed more fully in Chapter 4.

Factor Indexes

In addition to the Full, Verbal, and Performance Scale IQs, four factor-based index scores may be reported on the WISC-III Record Sheet. Since these factor indexes yield little additional information for the teacher searching the subtest scores for clues for detecting reading/learning disabilites, the analyses in Chapter 4 do not include them. However, they will be discussed in the section on factor analytic studies in Chapter 5.

Subtest Scaled Scores

The subtest scaled scores are the most important scores the WISC-III yields for the teacher, because they can be analyzed for the intrastudent variations they may reveal. The norm mean of each subtest is 10, but more important is the student's own subtest mean on the verbal tests and on the performance tests, and how much the student varies from these means on the separate subtests of each scale. In other words, a student's performance is not compared to what others have done; it is compared to his or her own performance on the other subtests of the scale. Does the student show highs and lows in accomplishing the different tasks presented by the subtests?

Of particular interest in the assessment of reading/learning disabilities are the research studies that have shown that groups of students with reading/learning disabilities tend to score lower on certain subtests. On the WISC and WISC-R these subtests were Arithmetic, Coding, Information, Digit Span, and sometimes Vocabulary. By the 1980s the first four came to be known by the acronym, ACID. The ACID syndrome characterizing groups that are reading/learning disabled became so well known that it is discussed in the WISC-III manual (Wechsler, 1991, pp. 185, 212). However, evidence from recent studies of these groups with the WISC-III has led Kaufman (1994) to advocate the replacement of the ACID profile with the SCAD profile (Symbol Search, Coding, Arithmetic, and Digit Span). The

groups are not showing a weakness on the Information subtest on the WISC-III, but they are making low scores on the new subtest, Symbol Search.

Each subtest's relationship to reading is discussed in Chapter 3, and Chapter 4 will explain how to analyze the subtest scores for clues to the source of students' reading/learning difficulties.

CHAPTER 3

The WISC-III Subtests

This chapter discusses the six Verbal subtests and the seven Performance subtests and includes for each a brief description, an example question or task, the abilities measured, the method of scoring, time limits (if any), possible indications from high or low scores, and what relationship may exist between the subtest and reading ability. The examples presented are similar to those on the WISC-III but are not identical and were supplied by The Psychological Corporation.

The subtest information, particularly the statements regarding the abilities measured, has been compiled from a number of sources (Glasser & Zimmerman, 1967; Kaufman, 1994; Matarazzo, 1972; Rapaport, Gill, & Schafer, 1968; Sattler, 1988; and Wechsler, 1958). Information from the older sources is still applicable, because the nature of the subtest tasks has remained the same through the three editions of the test.

The possible indications from high and low scores and the relationships to reading have been suggested by clinicians and researchers who have worked with the WISC, WISC-R, and WISC-III since their publication. (See Chapter 5 for an overview of the research base.) These indications and relationships are not intended to be exclusive. They have simply been the most productive hypotheses. The perceptive teacher will find and explore other hypotheses in individual cases.

If you are looking at the scaled scores of a student with whom you have worked or at the scores in Appendix A, you can consider the norm mean of 10 as an average scaled score on each subtest, a score of 13 or above as high, and a score of 7 or below as low. However, since this compares the student

to what others have done, it is not as valuable as the intrastudent comparison that is demonstrated in Chapter 4.

Verbal Scale

Information

This subtest consists of 30 questions in ascending order of difficulty. The questions are factual, requiring very brief answers (usually 1 to 5 words). These basic facts are assumed to be generally available to average American children.

Examples: What is steam made of?
Who wrote *Paradise Lost?*

What the subtest measures. The Information subtest measures long-term memory of general information gained from experience and education. It taps the child's knowledge about common events, objects, places, and people. The subject is not required to find relationships between facts but only to demonstrate whether the subject has stored these facts as general knowledge. The subtest may also measure intellectual aggressiveness or drive.

Method of scoring. Each question is scored 1 or 0, untimed; the subtest is discontinued after five consecutive failures.

Indications from scores. High scores may indicate a good memory, an enriched background of a high cultural level with wide reading, or an alertness and interest in the surrounding environment. High scores may also suggest a child who is intellectually ambitious. Low scores may indicate a poor memory, hostility to a school-type task, a tendency to give up easily, a foreign language background, or a culturally deprived environment. Low scores may also reflect an orientation toward nonachievement.

The Information subtest may be compared to the Comprehension subtest. High Information and low Comprehension scores may indicate a child who is not able to synthesize and use information to solve problems. Low Information and high Comprehension scores may suggest limited factual knowledge

but good ability to use this limited knowledge to make appropriate judgments.

Relationship to reading. The Information subtest is part of the ACID syndrome that has characterized groups with reading/learning disabilities on the WISC and WISC-R. From an inspection of 50 WISC and WISC-R reading-related studies, Sattler (1988) reported that disabled readers ranked lowest on the Information subtest. Glasser and Zimmerman (1967) stated: "Items on this subtest basically represent typical school-influenced education, although it does measure more broadly based knowledge before age 7" (p. 43). Since most of the research concerned with the WISC series and reading disability has been carried out after children were identified as poor readers (often third grade or above), the possibility exists that their inability to read well has limited their opportunities to increase their fund of general information. On the other hand, the inability to store information (poor memory) may have hindered their progress in reading. Whether the student's best learning modality is auditory or visual also may be a factor. Students who learn best through their ears rather than their eyes may have difficulty in reading (though not necessarily), but they may still accumulate information rapidly from television, films, conversations, and discussions. Thus, there have been poor readers who made average or above scores on the Information subtest, indicating that they were alert enough to pick up these facts in spite of their reading disability.

There is some evidence that the Information subtest will not continue to be a low subtest for groups of disabled readers on the WISC-III. Changes in item content (7 of the 30 items are new, and 2 are substantially modified) and the fact that the Information subtest (a school-like task) is no longer administered first in the battery (as it was on the WISC and the WISC-R) may affect disabled readers' test performance positively (Kaufman, 1994).

Similarities

This subtest consists of 19 pairs of words. Subjects must identify the similarities, either essential or superficial, among

objects, substances, facts, or ideas. There is a sample item to clarify the task.

Examples: In what way are a saw and a hammer alike?
In what way are a circle and a triangle alike?

What the subtest measures. The Similarities subtest assumes that the subject has obtained facts and ideas from exposure to information both at home and at school and should be able to see essential relationships between them. The subtest thus measures long-term memory, concept formation, ability to see associational relationships, and logical and abstract thinking. It also measures the ability to select and verbalize relationships between two concepts that seem dissimilar at first. (As the items become more difficult, the superficial dissimilarity becomes greater.)

Method of scoring. The first 5 pairs are scored 1 or 0, untimed; the remaining 14 word pairs are scored 2, 1, or 0, untimed. For the latter, 1 point is given if the subject gives a likeness at the concrete level, either descriptive ("a saw and a hammer are both made of metal and wood") or functional ("a saw and a hammer are both used to work with"). Two points are given for a more abstract likeness ("they are both tools for building"). The subtest is discontinued after four consecutive failures.

Indications from scores. High scores may indicate many items associated at the concrete level and fewer items associated at the abstract level. (Only the examiner can give this information, as the score alone will not differentiate.) The level of concept formation achieved is important since the more abstract the response, the higher the level of intelligence. Low scores may indicate an overly concrete mode of approach (subject cannot get beyond the concrete level of similarity), rigidity of thought processes (subject cannot find relationships when the two objects appear to be dissimilar), or negativism (subject insists that the objects are not alike).

The Similarities subtest may be compared to the Vocabulary subtest. Both measure level of abstract thinking and ability to form concepts, but the Similarities subtest is perhaps a purer measure and less likely to be depressed by reading dis-

ability. An average or above average Similarities score combined with a low Vocabulary score would suggest that the subject has the mental ability to do abstract thinking, but that opportunities to learn words have been restricted. Conversely, high Vocabulary and low Similarities scores may suggest difficulty in forming abstract concepts but good ability in understanding the meaning of individual words.

Relationship to reading. Poor readers do not seem to be unduly penalized by this subtest, since they can obtain the facts and ideas necessary for concept formation in ways other than reading. Also, poor readers can get credit for the concrete level of abstraction if they are unable to function at the higher level.

Arithmetic

Arithmetic, the only timed subtest on the Verbal Scale, contains 24 word problems requiring mental computation (no pencil and paper allowed) in ascending order of difficulty. For the first five items, the examiner presents picture cards to the child and reads aloud the problems related to each picture; these problems are administered only to subjects under the age of 7 or those suspected of intellectual deficiency. Items 6–18 are read aloud by the examiner with no visual stimulus presented. Problems 19–24 are presented on cards for the subject to read aloud before the timing begins. If the subject has a visual or reading problem, these six problems also may be read aloud by the examiner.

Examples: Sam had 3 pieces of candy and Joe gave him 4 more. How many pieces did Sam have altogether?

If 2 apples cost 35 cents, what will be the cost of a dozen apples?

What the subtest measures. The Arithmetic subtest measures the ability to attend and to focus concentration in order to extract the relations involved between the numbers. Concentration may be defined as an "active relationship with reality," in which the individual consciously keeps out all material (cognitive and emotional) not directly pertinent to the

task (Rapaport et al., 1968). The subject must be able to deal with abstract concepts of numbers and to perform the basic numerical operations of addition, subtraction, multiplication, and division. These basic operations are presented in order of difficulty so that subjects are not required to perform an operation to which they have not been exposed many times in school. Thus, the emphasis in this subtest is placed not on mathematical knowledge, per se, but on mental alertness and concentration.

Method of scoring. Each problem is scored 1 or 0 and timed separately, ranging from 30 seconds to 75 seconds per problem, depending on the difficulty. For items 19–24, speed of response can affect the child's score as 1 bonus point is awarded for each correct solution given within 10 seconds. The Arithmetic subtest is discontinued after three consecutive failures.

Indications from scores. Glasser and Zimmerman (1967) stated: "Arithmetic is more likely than some of the subtests to reveal important clues to personality and attitudes toward school achievement. For instance, the authority-dominated youngster who is eager to please may do quite well, while the resistant child who refuses even to try may do very poorly" (p. 39). Thus, high scores may indicate an obedient teacher-oriented student, good concentration, or facility in mental arithmetic. Low scores may indicate distractibility, anxiety over a school-like task, or a mental block toward anything to do with mathematics. Low scores may also indicate poor school achievement because of rebellion against authority or because of cultural disadvantage. Transient emotional reactions may depress the score if the child is worried about some personal problem.

Arithmetic may be compared to Digit Span. Although both require the two noncognitive functions of attention and concentration, Digit Span relies more on attention span and Arithmetic more on concentration (Glasser & Zimmerman, 1967; Rapaport et al., 1968).

Relationship to reading. In a review of 20 reading-related WISC studies, Huelsman (1970) found that 100% of the studies reported low scores on the Arithmetic subtest. Searls (1972) found that 91% of the 33 such studies she reviewed reported

low scores on Arithmetic. From an inspection of 30 WISC and WISC-R reading-related studies, Sattler (1988) reported that disabled readers ranked lowest on the Information subtest, with Arithmetic in the next-to-lowest rank. Because Arithmetic requires the use of noncognitive functions (attention and concentration) combined with the use of cognitive functions (manipulating abstract concepts, knowledge, and use of numerical operations), it may doubly penalize the poor reader. Since children are not tested when they begin school but only after they have developed a reading problem, it is impossible to tell whether reading disability has prevented their acquiring in school the knowledge necessary for success on this subtest, or whether their inability to attend and concentrate has affected learning in both areas of reading and mathematics. Farr (1969) concluded that the Information, Arithmetic, and Vocabulary subtests were probably the ones most affected by the lack of ability to broaden knowledge through reading. These three subtests correspond to Bannatyne's (1971) Acquired Knowledge category, in which groups of children with learning disabilities have shown deficits (Smith, Coleman, Dokecki, & Davis, 1977b). (See Chapter 3 for further discussion.)

Vocabulary

This subtest is composed of 30 words to be orally defined; the words (nouns, verbs, and adjectives) are arranged in order of increasing difficulty.

Examples: What is a_____?
What does_____mean?

What the subtest measures. Vocabulary is considered to be the best single verbal measure of general intelligence on the WISC-III. It measures learning ability, word knowledge acquired from experience and education, richness of ideas, kind and quality of language, and level of abstract thinking. Home background and educational opportunity can affect the score to a great extent.

Method of scoring. Each definition is scored 2, 1, or 0, untimed. A 2-point answer would be one giving a good synonym, a major use, a general classification, or a correct figurative use. Poverty of content is penalized in that 1 point is given for a vague or less pertinent synonym or minor use. The Vocabulary subtest is probably one of the most difficult to score objectively in spite of the sample answers given in the test manual. It is discontinued after four consecutive failures (responses scored 0).

Indications from scores. High scores often indicate a good family or cultural background or good schooling, as well as the ability to conceptualize. Low scores may indicate limited educational or family background or the inability to verbalize. Children from foreign language backgrounds or those from cultures where they have not been encouraged to express themselves verbally may have depressed scores.

The Vocabulary subtest may be compared to the Similarities subtest. Both measure level of abstract thinking and ability to form concepts, but the Similarities subtest is perhaps a purer measure and less likely to be depressed by reading disability. An average or above average Similarities score combined with a low Vocabulary score would suggest that the subject has the mental ability to do abstract thinking, but that opportunities to learn words have been restricted. Conversely, high Vocabulary and low Similarities scores may suggest difficulty in forming abstract concepts but good ability in understanding the meaning of individual words.

Relationship to reading. Research is inconclusive regarding poor readers' performance on this subtest. In some studies groups of poor readers made low Vocabulary scores, yet in others they did not. In Sattler's (1988) ranking of disabled readers' average subtest scores in 30 WISC and WISC-R studies, Vocabulary was ranked fifth from the bottom, with the ACID syndrome subtests occupying the four lowest ranks. Early evidence from WISC-III studies has not identified Vocabulary as a subtest on which disabled readers score low. The determining factor may be that children of the 1990s have more ability and opportunity to develop their vocabulary and level of con-

ceptualization from aural experiences (television, films, conversations, and discussions).

Comprehension

The title of this subtest is misleading to teachers who are accustomed to thinking of comprehension as a component of the reading act. Perhaps a better title would be "Common Sense" or "Practical Judgment." The subtest is composed of 18 questions designed to find out whether children have funds of practical information that they can use to cope with and solve problems of social behavior.

Examples: What should you do if you see someone forget a book when leaving a seat in a restaurant?
Why should you keep your money in a bank?

What the subtest measures. This subtest measures the extent to which children have acquired the social and moral values of the major American culture through everyday living experiences both at home and at school. It also measures ability to use practical knowledge and judgment in social situations and reflects knowledge of conventional standards of behavior.

Method of scoring. Each question is scored 2, 1, or 0, depending on the degree of understanding expressed and the quality of the responses. Untimed, the subtest is discontinued after three consecutive failures.

Indications from scores. High scores may indicate wide experience, ability to organize knowledge, social maturity, or an ability to verbalize well. High scores may also indicate a child who has learned the rules of conventional behavior in our society, who knows the "right" answers, but who does not necessarily put them into practice. Low scores may indicate overdependency (failure to take personal responsibility), overly concrete thinking, inability to express ideas verbally, or a creative individual looking for unusual solutions. (A child whose background lies outside the major culture may be penalized since the correct answers are based on middle-class behavior standards.)

The Comprehension subtest may be compared to the Information subtest. High Comprehension and low Information scores may suggest limited factual knowledge but good ability to use this limited knowledge to make appropriate judgments. Low Comprehension and high Information scores may indicate a child who is not able to synthesize and use information to solve problems.

Relationship to reading. Poor readers are usually not penalized by the Comprehension subtest, as this is the type of information that can be acquired through practical experience and oral discussion.

Digit Span

This supplementary (or alternate) subtest consists of two parts. In Digits Forward the examiner reads aloud a group of random numbers, and the subject repeats the numbers in the same order as spoken. Digits Forward begins with a series of 2 digits and continues through a series of 9 digits. In Digits Backward the examiner reads aloud a group of random numbers, and the subject repeats the numbers in reverse order. Digits Backward presents a series of 2 digits through a series of 8 digits. There is a sample item to clarify the Digits Backward task.

Example: 2–5–6–1–8–3

What the subtest measures. The Digit Span subtest measures attention span, concentration (Digits Backward), immediate auditory memory, and auditory sequencing. Attention may be defined as the free use of energies not specifically tied to any particular emotion, interest, or drive. These energies are at the disposal of the subject to be used in thinking and dealing with reality. Attention is both automatic and involuntary as opposed to concentration, which is conscious and voluntary (Rapaport et al., 1968).

The two parts of the subtest appear to be measuring different sets of skills. Digits Forward requires skill at the rote level of short-term memory, whereas Digits Backward requires that the subject hold the digits slightly longer in memory and

manipulate them before restating them in reverse order. Digits Backward may thus indicate flexibility, good tolerance for stress, or excellent concentration—in short, more complex cognitive processing than Digits Forward. Research also suggests that Digits Forward measures sequential or successive processing, while Digits Backward measures successive processing plus planning ability (Schofield & Ashman, 1986).

Method of scoring. Each subject begins with the series of 2 digits forward, repeating them after the examiner has said the 2 digits. The subject has two trials with each series. Two points are given if both trials are passed (all digits repeated in correct order), 1 point if one trial is passed, and 0 points if neither trial is passed. Digits Forward is discontinued after failure on both trials of any series of digits (2–9). Digits Backward is then administered, scored, and discontinued in the same manner. The scores on both parts of the subtest are added together for the total Digit Span score. Thus the examiner is the only one who can determine whether a significant difference exists between the lengths of the forward and backward spans. The subtest is untimed as far as the subject's response is concerned, although the examiner says the digits at the rate of approximately one per second.

Indications from scores. High scores may indicate good rote memory and immediate recall, with ability to attend well in a testing situation. Low scores may indicate high anxiety in a testing situation, a possible hearing defect, disability in auditory sequencing, or high susceptibility to fatigue. According to Glasser and Zimmerman (1967), the most common cause of low scores has been found to be anxiety that impaired the attention span. Anxiety in the testing situation is mentioned as a possible cause of low scores on several of the WISC-III subtests. The teacher will need to confer with the examiner as to his or her observation of the student's behavior during the administration of the test, as specific test anxiety may be manifested in a variety of ways.

Glasser and Zimmerman's observation regarding anxiety was based on data from the WISC, when Digit Span was administered as the sixth subtest (at the end of the Verbal Scale). In the original edition of this monograph (based on the WISC), it

was suggested that the possibility of "peak out" should be considered as a factor in low scores. The rationale was that, if the auditory verbal input of the Verbal Scale was difficult for the subjects, students already might have passed the point of their best ability to hold and manipulate mental images without any visual aids to help. On the WISC-III (as on the WISC-R), Digit Span is not administered until all 10 required subtests have been given. Although Verbal and Performance subtests are presented alternately on the WISC-III, the administration of Digit Span at the end of the testing session may now make the score particularly vulnerable to fatigue.

Digit Span may be compared to Arithmetic. Although both require the two noncognitive functions of attention and concentration, Digit Span relies more on attention span and Arithmetic more on concentration (Glasser & Zimmerman, 1967; Rapaport et al., 1968).

Relationship to reading. Digit Span is one of the subtests on which groups of disabled readers have made low scores (the ACID profile). In Sattler's review (1988) of 30 WISC and WISC-R studies, Digit Span was the third lowest ranked subtest for poor readers. Digit Span, together with Arithmetic and Coding, form Bannatyne's (1974) Sequential category, in which groups of reading disabled children have shown deficits (Rugel, 1974). Malter (cited in Sattler, 1982) suggested that children with low Digit Span scores may have difficulty acquiring phonics skills that depend on memorization and sequencing of sound/symbol relationships.

Performance Scale

Picture Completion

This timed subtest consists of 30 drawings of objects from everyday life, each of which has an important missing element to be identified. The pictures are presented one at a time on separate cards. There is a sample item to clarify the task.

Example: Pictures a dog with one leg missing.

What the subtest measures. Picture Completion measures alertness to the environment, visual memory, attention to detail, and visual perception (closure). It further measures the ability to identify and isolate essential from nonessential characteristics.

Method of scoring. Picture Completion is scored 1 or 0 and timed, the subject having to respond to each picture either by pointing or naming the essential missing part within 20 seconds. The subtest is discontinued after five consecutive failures.

Indications from scores. High scores may indicate experience with similar commercial games, the ability to establish a learning set quickly, familiarity with the objects pictured, or good visual perception and concentration. Low scores may indicate susceptibility to irrelevant details, negativism (insisting that nothing is missing), or anxiety that affects attention and concentration. Probably the most common source of low scores is poor attention and concentration due to anxiety (Glasser & Zimmerman, 1967).

The Picture Completion score may be compared to that on Block Design. An average or above average score on Picture Completion as compared to a low score on Block Design may indicate a child whose visual perception is adequate but who has difficulty reproducing designs through visual-motor-spatial coordination. The score on Picture Completion also may be compared to that on Picture Arrangement, since both stress perception of details, with Picture Arrangement further requiring the logical manipulation of details.

Relationship to reading. Poor readers often do well on this subtest in spite of the fact that it requires attention and concentration. In a review of 33 WISC studies, Searls (1972) found Picture Completion to be the subtest on which groups of disabled readers most consistently made high scores, with 61% of the studies reporting this subtest significantly high. Reviewing 30 WISC and WISC-R studies, Sattler (1988) reported that inadequate readers' highest ranked subtest was Picture Completion. Kaufman (1979) has proposed that children with reading and learning disabilities may succeed on Picture Completion because the stimuli are meaningful (as opposed to abstract), nonverbal (pictures rather than words), and visually (rather than auditorily) presented. On the WISC-III, Picture Comple-

tion is the first subtest administered, replacing Information, which was first on the WISC and WISC-R. It is a good ice-breaker because it presents a concrete, colorful, game-like task.

Coding

This timed subtest requires the subject to match and copy symbols in blank spaces provided on the test sheet. There are two parts, Coding A and Coding B. Coding A is for children under 8, with 59 symbols to be filled in, using a guide of symbols associated with simple shapes. Coding B is for children 8 or over, with 119 symbols to be filled in, using a guide of symbols associated with numerals. The Coding subtest requires the ability to use a pencil. The examiner demonstrates the task with two sample items for Coding A and three sample items for Coding B.

Example: Coding B

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Below this guide are rows of numerals in random order. Subject must match the numeral and write below each one the symbol associated with it.

What the subtest measures. Coding measures visual-motor dexterity and the association of meaning with a symbol. It also measures the ability to memorize quickly so that looking back at the guide is not necessary. Finally, it measures the ability to learn from visual plus kinesthetic stimuli since the subject must write as well as look.

Method of scoring. The subtest is scored 1 point for each square correctly filled in and is timed, with 120 seconds allowed for completion of all squares. The subtest is at one level of difficulty and is not discontinued until the time limit is reached. On Coding A, a subject who completes all the items

correctly before the end of the 120 seconds may receive up to 6 bonus points for speed. On Coding B, there are no bonus points awarded.

Indications from scores. High scores may indicate high motivation and a great degree of concentration and sustained energy. They may also indicate visual-motor dexterity or the ability to learn new material associatively and reproduce it with speed and accuracy. Low scores may indicate specific visual defects, visual-motor coordination problems, poor pencil control, or disinterest in a school-like task. Sometimes a low score is caused by excessive concern in reproducing the symbol exactly, thus slowing down the performance. Coding may be compared to Symbol Search. Coding measures psychomotor speed, while Symbol Search measures mental speed. Also, Symbol Search places more demands on the ability to plan effectively than Coding does.

Relationship to reading. Coding is the only subtest on the Performance Scale of the WISC or WISC-R on which groups of poor readers have consistently scored low. (There is early evidence that the new WISC-III subtest, Symbol Search, may be a second Performance subtest that is difficult for poor readers.) Coding was reported low in 76% of the WISC studies reviewed by Searls (1972). Sattler (1988) found that Coding was the fourth most difficult subtest for disabled readers on the WISC and WISC-R. (Information, Arithmetic, and Digit Span were ranked first, second, and third, respectively.) Coding combined with Arithmetic and Digit Span formed Bannatyne's (1974) Sequential category, in which groups of reading-disabled children have shown deficits (Rugel, 1974). Coding, like Arithmetic, is a timed, school-like task. Furthermore, subjects must concentrate, move their eyes quickly from the guide to the rows below, write, and associate meaning with a symbol. Coding also requires left-to-right progression. All these factors often make the task difficult for the disabled reader.

Picture Arrangement

This timed subtest consists of 14 sets of picture cards to be put in the right order to tell a logical story of actions or con-

sequences. The picture cards are presented by the examiner in a specified mixed order; the subject must rearrange the cards within a time limit. The picture sequences range from the easiest with 3 picture cards to the most difficult with 6 picture cards. There is a sample item to clarify the task.

Example: The picture cards resemble comic strip panels that have been cut apart.

What the subtest measures. Picture Arrangement measures cause and effect relationships, visual sequencing, attention to details, visual perception, and concept formation. It may also indicate social alertness and common sense.

Method of scoring. Each set is timed with limits ranging from 45 seconds to 60 seconds. The first two sets are scored 2, 1, or 0, according to success on the first or second trial. The remaining 12 picture sets are each scored 2 points for completing the set in the correct arrangement, with up to 3 bonus points given for speed of response. On the last set there is an alternate arrangement of the cards that is given partial credit (1 point) but is not eligible for time bonuses. The subtest is discontinued after three consecutive failures.

Indications from scores. High scores may indicate alertness to detail, forethought, planning ability, logical sequential thought processes, or ability to synthesize parts into intelligible wholes. Low scores may indicate a problem in visual organization (sequencing), inattentiveness, anxiety, failure to use minimal cues, or lack of background experience with the situations depicted. The score on Picture Arrangement may be compared to that on Picture Completion, since both stress perception of details, with Picture Arrangement further requiring the logical manipulation of details. Picture Arrangement may also be compared to scores on Picture Completion together with Block Design; all require visual perception, but Picture Arrangement involves sequencing. In addition, Picture Arrangement may be compared to Object Assembly in that both require inductive reasoning (working from parts to a whole) without a model to follow, but Picture Arrangement involves sequencing as well. Finally, the score on Picture Arrangement, when combined with

the score on the Block Design subtest, provides a good nonverbal measure of general intelligence.

Relationship to reading. Poor readers do not seem to be penalized. Picture Arrangement was the second highest ranked subtest for disabled readers in Sattler's (1988) review of 50 WISC and WISC-R studies. The comic strip format is attractive, and the situations presented are generally familiar to most children. Although perception of details and logical sequencing are certainly abilities involved in the reading task, poor readers may succeed on this subtest because of the meaningful nature of the stimuli (Kaufman, 1979).

Block Design

This timed subtest consists of 12 two-dimensional abstract designs to be reproduced with red and white blocks (cubes). The first 2 designs are copied from a block model constructed by the examiner in front of the child and are administered only to subjects under age 8 or those suspected of intellectual deficiency. The remaining 10 designs are reproduced from a one-dimensional model (picture). The first pattern uses only 2 blocks; the next 8 use 4 blocks; the last 3 use 9 blocks.

Example: Subjects are shown this picture on a card. They must reproduce the design with the blocks.

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What the subtest measures. Block Design is considered the best single nonverbal measure of general intelligence on the WISC-III. It measures the perception, analysis, synthesis, and reproduction of abstract designs. It requires logic and reasoning to be applied to spatial relationships. It also involves nonverbal concept formation and visual-motor-spatial coordination. The subject must perceive the design on the card, analyze the component parts (making the transfer from one di-

mension to two dimensions), and put the parts together to reproduce the design.

Method of scoring. Each design is timed with limits ranging from 30 seconds to 120 seconds. The first 3 designs are scored 2, 1, or 0, according to success on the first or second trial. The remaining 9 designs are scored 4 points for each pattern correctly reproduced, with up to 3 bonus points given for speed. The subtest is discontinued after two consecutive failures.

Indications from scores. High scores may indicate good conceptualizing ability, analyzing and synthesizing talents, speed and accuracy in sizing up a problem, successful use of trial and error, flexibility in problem solving, or excellent hand–eye coordination. Low scores may indicate a visual perception problem, poor spatial conceptualization, or a visual-motor problem.

Block Design may be compared to Object Assembly; both measure perceptual organization and spatial visualization ability. However, in Block Design the subject uses deductive reasoning, working from the whole to the parts, while in Object Assembly the subject uses inductive reasoning, working from the parts to the whole. Block Design provides a model; Object Assembly does not. Block Design also may be compared to Picture Completion. A low Block Design and high Picture Completion contrast may indicate adequate visual perception hampered by a visual–motor–spatial problem.

Relationship to reading. Poor readers are not necessarily penalized by this subtest. Block Design was the third highest ranked subtest for disabled readers in Sattler's review (1988) of 30 WISC and WISC–R studies. Block Design, together with Picture Completion and Object Assembly, formed Bannatyne's (1968) Spatial category; he found that severely disabled readers consistently scored highest in this category. For subjects who are unable to express themselves verbally, Block Design provides a good measure of reasoning.

Object Assembly

This timed subtest has five jigsaw puzzles to be assembled, each of a single common object. The puzzle pieces are not

interlocking, so the subject must rely more on visualization of the whole object than on the shape of the pieces. The subject is told the name of the object on the first two puzzles, but not on the other three. The puzzles are progressively more difficult and all must be attempted by the subject. There is a sample puzzle to clarify the task.

Example: The pieces of each puzzle are laid out in a specified manner before the subject. The number of pieces varies from 6 to 9.

What the subtest measures. Object Assembly measures part-to-whole relationships using visual anticipation, simple assembly skills, and visual-motor-spatial coordination. The subject must work toward the whole without a model to follow and, on the last three puzzles, without being told the name of the object.

Method of scoring. Each puzzle is timed separately, ranging from 120 seconds to 180 seconds. The first three puzzles receive 5 points each for completion within the time limits, with up to 3 bonus points possible for speed of response. The last two puzzles receive 6 points each, with 4 bonus points possible. If the subject correctly joins certain pieces yet does not complete the puzzle, partial credit is given. There is no discontinuation point; all puzzles must be attempted.

Indications from scores. High scores may indicate experience in assembling puzzles, good motor skills, successful use of trial and error, or ability to visualize the whole from the parts. Low scores may indicate minimal experience in construction tasks, lack of planning ability, or visual perception or visual-motor deficiencies. Low scores may also indicate a highly verbal subject who lacks interest in assembly tasks.

Object Assembly may be compared to Block Design; both measure perceptual organization and spatial visualization ability. However, in Object Assembly the subject uses inductive reasoning, working from the parts to the whole, while in Block Design the subject uses deductive reasoning, working from the whole to the parts. A low Object Assembly score and high Block Design score may suggest that nonverbal inductive reasoning skills are not as well developed as nonverbal deduc-

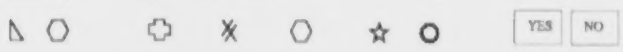
tive reasoning skills, or that the subject is unable to mentally form a visual representation of the objects. In addition, Object Assembly may be compared to Picture Arrangement in that both require inductive reasoning without a model to follow, but Picture Arrangement involves sequencing as well.

Relationship to reading. Poor readers do not seem to be penalized. Object Assembly, Picture Completion, and Block Design formed Bannatyne's (1968) Spatial category; he found that severely disabled readers consistently made their highest scores in this category. Object Assembly is gamelike and has intrinsic appeal to children. It is not difficult for children who are oriented toward concrete thinking or toward action.

Symbol Search

This new supplementary (or alternate for Coding) timed subtest is the first addition to the subtest array since the original WISC was published. It presents a series of paired groups of symbols, each pair consisting of a target group and a search group. On Symbol Search A (for children under age 8), the target group contains one target symbol, and the search group three symbols. The subject indicates whether the target symbol appears in the search group by marking a "Yes" box or a "No" box. On Symbol Search B, the target group contains two symbols and the search group five. The subject indicates whether either of the two target symbols appears in the search group by marking the appropriate box. The examiner demonstrates the task with two sample items, and the subject practices on two additional items before the timing begins. The Symbol Search subtest requires the ability to use a pencil.

Example: Symbol Search B



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What the subtest measures. Symbol Search measures speed of visual search, speed of mental processing, visual short-term memory, spatial visualization, and visual-motor coordination.

Method of scoring. In each part (A or B) there are 45 items all at one level of difficulty, and the subtest is not discontinued until the time limit of 120 seconds is reached. Each correct response is awarded 1 point; however, the score for the subtest is the number of correct responses minus the number of incorrect responses.

Indications from scores. High scores may indicate high motivation, good ability to attend and concentrate, good planning ability, and an excellent visual short-term memory. Low scores may indicate inadequate visual acuity, visual perception problems, anxiety, or distractibility. Low scores may also indicate fatigue or boredom since Symbol Search, if given as a supplementary subtest, is administered at the end of the testing session. Symbol Search may be compared to Coding. Symbol Search measures mental speed, while Coding measures psychomotor speed. Also, Symbol Search places more demands on the ability to plan effectively than Coding does.

Relationship to reading. Because Symbol Search is a new subtest, it does not have the rich clinical and research history of the other subtests. The relationship to reading is tentative at this point. As part of the standardization process, the WISC-III was administered to a sample with learning/reading disabilities. The lowest subtest mean scores were for Symbol Search, Coding, Arithmetic, and Digit Span. The Information subtest score was in the middle of the range of scores. Thus the ACID profile was replaced with the SCAD profile. Kaufman (1994) has summarized several recent studies that seem to support the SCAD profile for students with learning/reading disabilities. These studies will be discussed in more detail in Chapter 5.

Mazes

This timed subtest consists of 10 mazes of increasing difficulty, presented one at a time. Using a pencil, subjects must draw a line showing how to find their way from the center of

the maze to the exit. The examiner demonstrates the task by completing a sample maze.

Example: The mazes are similar to those found in children's commercial puzzle books.

What the subtest measures. Mazes measures planning and foresight, pencil control, and visual-motor coordination. Kaufman (1994) thinks Mazes is now more a measure of specific experience with maze books because children have access to so many game books filled with mazes like the ones on the WISC-III.

Method of scoring. Possible scores range from 2 to 5 points depending on the difficulty of the maze. Each maze must be completed within the time limits (ranging from 30 seconds to 150 seconds); otherwise, no points are given. Although illustrations are provided in the test manual to facilitate scoring decisions by the examiner, the scoring is complicated. The subtest is discontinued after two consecutive failures (score of 0).

Indications from scores. High scores may indicate planning efficiency, ability to follow instructions, or good pencil control combined with speed and accuracy. Low scores may indicate inability to delay impulsive action or poor visual-motor coordination.

Relationship to reading. On the WISC and the WISC-R, the examiner had the option of using either Coding or Mazes as the fifth subtest on the Performance Scale. Because Mazes takes longer to administer and score, this subtest has seldom been included in the test battery. On the WISC-III, Mazes is relegated to the role of supplement (or alternate if one of the required Performance tests is invalidated). Hence, no relationship to reading has been suggested. Kaufman (1994) believes that WISC-III Mazes is "a poor excuse for a subtest on a major intelligence test" (p. 61) and recommends that it not be administered to anyone for any reason (p. 62).

Summary

With the exception of Mazes and the new Symbol Search, WISC–III subtests have been researched and written about extensively in educational literature. For more detailed information about the subtests, the reader may want to consult one or more of the sources listed at the beginning of this chapter.

CHAPTER 4

How to Detect Reading/ Learning Disabilites

If the assessment of a reading/learning disability takes place in a clinical setting, the WISC-III is only one of a battery of tests used to identify the physical, emotional, and intellectual characteristics of students. In the school setting the teacher relies on direct observation of performance and behavior (considered the most valuable assessment tool by many authorities), use of school records, informal testing of noted skill deficiencies, and an assessment of intellectual capacity whenever the latter is available. If the WISC-III is administered by school psychologists, they may be able, depending on their experience and background in curriculum, to suggest implications from WISC-III scores as to the deficiencies that may be hindering students' progress in reading. However, psychologists are trained to interpret the WISC-III from many perspectives and from many fields of knowledge. Teachers who teach reading have more knowledge about the reading process. More importantly, they know the students with whom they work daily better than do psychologists who see students for only short periods of time.

The complexity of the reading process and the interaction of many factors in the causation of reading/learning disabilities are well established (Harris & Sipay, 1985). Many of the abilities that appear to underlie performance on the WISC-III are also involved in the reading process: auditory and visual acuity and perception, attention and concentration, short- and long-term memory, receptive and expressive oral language, concept formation, abstract thinking, and the ability to profit

from environment and experience. Although research has identified certain characteristics of groups of students with reading/learning disabilities, we still know very little about the ways that the mentioned abilities (and other factors such as ethnic and cultural background, parental influence, and motivation) interact to affect the reading/learning ability of any particular individual.

The procedures suggested in this chapter encourage teachers to generate hypotheses as to individuals' cognitive strengths and weaknesses that may be involved in their reading disabilities, which can then serve as a basis for educational planning and remediation.

Full Scale IQ

In Chapter 2 it was pointed out that the Full Scale IQ, if within the Average range or above, is probably the least valuable score for the teacher. It may underestimate the cognitive abilities of disabled readers. A rather consistent pattern of low scores by groups of poor readers on certain subtests has emerged from summaries of research by Farr (1969), Huelsman (1970), Sattler (1988), Kaufman (1994), and others. In 1969 Farr hypothesized that if groups of poor readers have a Full Scale IQ in the Average range, they must have scored higher on other subtests to counteract the lower scores in the subtests possibly affected by their reading disability. Twenty-five years after Farr's statement, Kaufman (1994) cited the research confirming Farr's theory.

Therefore, the Full Scale IQ should be deemphasized by treating it in the following manner:

1. If the Full Scale IQ is in the Average range (90–109) or above, proceed to the analysis of Verbal and Performance Scale IQs.

2. If the Full Scale IQ is below the Average range, follow the psychologist's recommendations as to how the academic program may be adapted to the level of the student's ability to learn. Then proceed as in step 1.

Verbal and Performance Scale IQs

As has been stated, the importance of these IQs lies in the possible difference between them. If the difference is large, it may indicate that the student performs better on verbal tasks than on performance tasks, or vice versa. This is particularly true if the lower IQ is the result of consistently low scores on all subtests of the scale, rather than being due to two or three very low scores on certain subtests.

1. If the numerical difference between the Verbal and Performance IQs is 10 or less, proceed to the analysis of the subtest scaled scores to see if there are high and low scores within each Scale that are canceling each other. The procedures used to compute these two IQs may be masking strengths and weaknesses that exist within the verbal or performance areas.

2. If the numerical difference between the Verbal and Performance IQs is 11 or more, focus on the input–output modalities of the lower score as shown.

Processes and Modalities: WISC–III Verbal and Performance Scales

	Processes	Modalities
	Verbal Scale	
Input:	Auditory, verbal	Auditory acuity Auditory perception
Output:	Vocal, verbal	Verbalization
	Performance Scale	
Input:	Visual, nonverbal	Visual acuity Visual perception
Output:	Motor, nonverbal	Motor coordination

3. Check or recheck the following about the student where applicable.

- Hearing (speech reception threshold in decibels, possibility of nerve loss).
- Auditory perception, discrimination, and sequencing.
- Ability in verbal expression (e.g., describing a picture, telling the events of a story, or defining words at reading level).
- Vision (far point, near point, fusion, depth perception).
- Visual perception, discrimination, and sequencing.
- Motor coordination of small muscles in handwriting and construction tasks.

4. Generate hypotheses as to why the student's IQ was depressed on either scale.

5. Tentatively assume that the higher scale is more representative of the student's true level of functioning, then proceed to the subtest analysis.

Subtest Scaled Scores

In the search for students' strengths and weaknesses, these are the most valuable scores on the WISC-III. Make certain that you receive them from the psychologist. Kaufman (1994) recommends the following differences required for interpreting a significant strength or weakness: (a) any Verbal subtest score that differs by 3 or more points from the student's own mean on all Verbal subtests administered, and (b) any Performance subtest score that differs by 4 or more points from the student's own mean on all Performance subtests administered.

Looking for high and low scores is known as subtest profile analysis, the rationale for which is discussed in Chapter 5. The procedures will first be listed in outline form; later in this chapter they will be demonstrated with actual test scores. (The Mazes subtest is omitted from the analysis as it is so seldom administered.)

1. Using the WISC–III Data Sheet (Appendix B), record the scaled scores for all Verbal subtests administered, find the student's mean on these subtests, and round it to the nearest whole number.

2. Determine the numerical difference between the student's mean on the Verbal subtests and each Verbal subtest score. If this difference is 3 or more, write the number and the sign indicating the direction of the difference to the right of the subtest score in the "Difference from Verbal Mean" column. If the difference is less than 3, write only a plus or minus sign, depending on the direction. If the subtest score is the same as the mean, make no mark.

3. Repeat steps 1 and 2 for the Performance subtests. Remember that a difference of 4 or more points is necessary for significance on the Performance subtests.

4. Using the worksheet, Abilities Measured by Two or More WISC–III Subtests (Appendix C) and working vertically, enter the differences and their direction (plus or minus) under each subtest. Then, consider the abilities as listed. If an ability has at least one significant plus difference and pluses in the other subtests, mark that ability in the left-hand margin with an "S" for strength. If an ability has at least one significant minus difference and minuses in the other subtests, mark that ability with a "W" for weakness. (If an ability does not have at least one significant difference, you cannot be as sure that a strength or weakness really does exist. You would interpret such an ability as showing a tendency in one direction or the other.) Finally, on those abilities with both pluses and minuses, put a question mark, indicating that the results are conflicting and further exploration is needed.

5. Make comparisons between the specific subtests as suggested in Chapter 5 (see Figure 1). A difference of 3 or more points between subtests may be considered significant (Wechsler, 1991). The following list is not exhaustive; other comparisons may be made by referring to subtest interpretations in Chapter 5.

   a. Information versus Comprehension: Information measures amount of information retained, and

Comprehension measures the ability to use information in practical situations.

b. Similarities versus Vocabulary: Both measure the level of abstraction in concept formation. Similarities is the purer measure of this, and Vocabulary indicates a wider range of learning ability.

c. Arithmetic versus Digit Span: Arithmetic relies more on concentration, and Digit Span relies more on attention span. A discrepancy between the two scores may indicate which function is giving the subject more difficulty.

d. Picture Completion versus Picture Arrangement: Both require attention to details, but Picture Arrangement further requires the logical manipulation of details.

e. Picture Completion and Block Design versus Picture Arrangement: All three subtests require good visual perception, but Picture Arrangement requires sequencing as well.

f. Object Assembly versus Picture Arrangement: Both involve inductive reasoning (working with parts toward an unknown whole). In addition, Picture Arrangement involves sequencing.

g. Picture Completion versus Block Design: Both require good visual perception, but Block Design involves reproduction of designs by visual-motor means.

h. Object Assembly versus Block Design: Both measure perceptual organization and spatial visualization ability. However, in Block Design the subject uses deductive reasoning, working from the whole to the parts and back again to the whole, using a model. In Object Assembly the subject uses inductive reasoning, working toward the whole from the parts without having a model.

i. Coding versus Symbol Search: Although both require visual-motor-spatial coordination, Coding depends more on psychomotor speed and Symbol Search depends more on mental speed.

Figure 1
Comparisons Between Specific Subtests

	Comprehension	Vocabulary	Digit Span	Picture Arrangement	Block Design	Symbol Search
Information	Amount of information retained versus ability to use information					
Similarities		Level of concept information plus range of learning ability				
Arithmetic			Concentration versus attention			
Picture Completion				Attention to details plus manipulation of details		
Picture Completion and Block Design				Visual perception plus visual sequencing		
Object Assembly				Inductive reasoning plus sequencing		
Picture Completion					Visual perception plus visual-motor-spatial coordination	
Object Assembly					Inductive reasoning versus deductive reasoning	
Coding						Psychomotor speed versus mental speed

Demonstration of Analysis Procedures With Actual Test Scores

When the examiner who administers the WISC-III writes the psychological report, she or he may or may not include the specific test scores. Providing the examiner with a data sheet in advance is a good way to get the information you need. The WISC-III Data Sheet (Appendix B) may be used for this purpose. In the following discussion the analysis procedures will be demonstrated using actual test scores entered on the WISC-III Data Sheet in Figure 2.

Full Scale IQ

The Full Scale IQ is 101, falling within Wechsler's Average range. Judging by this score alone, this boy should be able to learn to read. Yet he was reading two years below grade level. The analysis of his subtest scores will show that this Full Scale IQ is probably an underestimate of his intellectual ability.

Verbal and Performance IQs

The difference between the Verbal and Performance IQs is 14, with the Performance IQ the lower. This scale relies heavily on the visual modality, so the student may need further tests of visual acuity and perception. The scale also relies on visual-motor coordination. Additional evidence needed would be handwriting samples and information as to how the student performs on construction tasks. In addition, all Performance subtests are timed, which raises the question as to whether the pressure of time limits caused anxiety or hurried movements that affected the scores. We need to know how well Cory performs under untimed conditions. However, before pursuing these hypotheses, we will look at the subtest scaled scores to see if the lower Performance IQ is the result of lower scores on all Performance subtests or only certain ones.

Figure 2
WISC–III Data Sheet With Scores Entered

WISC-III Data Sheet

Name of Subject Cory W. Age 9-7 Date 10/15/95

Examiner Searls Sex M Grade 4

Full Scale IQ 101 Wechsler Classification of Intelligence

Verbal IQ 108 Average

Performance IQ 94 Difference between V and P IQs 14

VERBAL SCALE	Subtest Scaled Scores	Diff. from Verbal Mean (3 pts.=sig.)
1. Information	12	+
2. Similarities	12	+
3. Arithmetic	8	–
4. Vocabulary	12	+
5. Comprehension	13	+3
6. Digit Span (Supplement)	5	-5
Sum of Verbal Tests	62	
Verbal Mean	10.2=10	

PERFORMANCE SCALE		Diff. from Perf. Mean (4 pts.=sig.)
7. Picture Completion	13	+5
8. Coding	3	-5
9. Picture Arrangement	6	–
10. Block Design	13	+5
11. Object Assembly	10	+
12. Symbol Search (Supplement)	7	–
Sum of Performance Tests	52	
Performance Mean	8.4=8	

Subtest Scaled Scores

Cory's Verbal subtest mean is 10. He scored 3 points above this mean on Comprehension, and 3 points below on Digit Span. (Note that, although Digit Span is a supplementary test not used in determining the Verbal IQ, it is included in profile analysis.) These differences of 3 or more points on

Verbal subtests are significant ones; the amount and direction of each is recorded. On the other Verbal subtests he scored above his mean on three (Information, Similarities, and Vocabulary) and below on one (Arithmetic), but not significantly, so we record only a plus or minus sign on these.

Cory's mean on the Performance subtests is 8. He scored 5 points above this mean on Picture Completion and Block Design, and 5 points below on Coding. Differences of 4 or more points on Performance subtests are significant ones; the amount and direction of each is recorded. Cory's score on Object Assembly was not significantly above his mean, so we use only a plus sign. He scored below his mean on Picture Arrangement and Symbol Search, but not significantly, so we use only a minus sign. (Note that, although Symbol Search is a supplementary test not used in determining the Performance IQ, it is included in profile analysis.)

Looking for Strengths and Weaknesses

In order to identify Cory's strengths and weaknesses, we can use the worksheet, Abilities Measured by Two or More WISC-III Subtests, as illustrated in Figure 3. Taking the subtests one by one, we enter the differences and their direction from the WISC-III Data Sheet. The Information column has plus signs, the Similarities column has plus signs, the Arithmetic column has minus signs, etc.

Strengths. Cory seems to have strengths in four abilities: visual-motor-spatial coordination, abstract thinking, long-term memory, and ability to profit from environment and experience. Each of these abilities has at least one significant plus difference and pluses in the other subtests, and is marked in the left margin with an "S."

Weaknesses. Cory's weaknesses appear to be in these areas: visual-motor coordination, attention plus concentration, sequencing, school-like tasks, and short-term memory. Each of these abilities has at least one significant minus difference and minuses in the other subtests, and is marked in the left margin with a "W."

Conflicting data. The results are ambiguous for these abilities: visual perception, attention, concept formation, school-acquired knowledge, visualizing the whole without a model, and attention to details. Each of these abilities has both pluses and minuses, so we put a question mark in the left margin, indicating that further exploration is needed. Next we will look at specific subtest comparisons to see what information they may provide.

Figure 3
Identifying Strengths and Weaknesses From a Student's Test Data

Abilities Measured by Two or More WISC-III Subtests

Name of Subject Cory W. Date 10/15/95

	Abilities	Verbal Scale						Performance Scale					
		I	S	A	V	C	DS	PC	Cod	PA	BD	OA	SS
?	a. Vis-Perception							+5		−			
W	b. Vis-Motor-Coor								−5				−
S	c. Vis-Motor-Spat										+5	+	
?	d. Attention						−5	+5					
W	e. Attn + Concen			−					−5	−			−
?	f. Concept Form	+	+		+	+3				−	+5		
?	g. Sch-Acq-Knowl	+		−	+								
S	h. Abst. Thought		+		+						+5		
W	i. Sequencing						−5		−5	−			−
W	j. Sch-Like Task			−					−5				−
?	k. Visualize Whole									−		+	
W	l. S-T Memory			−			−5		−5				−
S	m. L-T Memory	+	+		+	+3							
?	n. Attn to Details							+5		−		+	
S	o. Environ-Exper	+			+	+3		+5					

Note I=Information, S=Similarities, A=Arithmetic, V=Vocabulary, C=Comprehension, DS=Digit Span, PC=Picture Completion, Cod=Coding, PA=Picture Arrangement, BD=Block Design, OA=Object Assembly, SS=Symbol Search

Comparison of Specific Subtests

A difference of 3 or more points is considered significant (Wechsler, 1991); differences of less than 3 points will not be discussed.

a. Information versus Comprehension: 1 point difference.

b. Similarities versus Vocabulary: Same score.

c. Arithmetic versus Digit Span: Digit Span is 3 points lower than Arithmetic. This may mean that attention span is more of a problem than concentration. However, in light of the identified weakness in attention plus concentration, we need to consider other possibilities for the discrepancy. Cory's strength in abstract thinking may have enabled him to do better in Arithmetic. Another possibility is that he found it easier to attend to the meaningful word problems in Arithmetic than the nonmeaningful random digits in Digit Span.

d. Picture Arrangement versus Picture Completion: These two subtests share the ability of visual perception, where the data were conflicting. Cory was high on Picture Completion and low on Picture Arrangement (a difference of 7 points), indicating that he could perceive important visual details when that was the only task involved. When he had to use that knowledge to sequence events, he did not do as well.

e. Picture Completion and Block Design versus Picture Arrangement: Cory was high on both Picture Completion and Block Design (13 on each) and low on Picture Arrangement (6). Since all three subtests require good visual perception but Picture Arrangement requires sequencing as well, this comparison strengthens our hypothesis that Cory has a weakness in sequencing ability.

f. Object Assembly versus Picture Arrangement: There was a difference of 4 points between these two sub-

tests, which both involve the ability to visualize the whole without a model, another area where the data were conflicting. Both subtests require inductive reasoning (working with parts toward an unknown whole). There is some evidence that Cory is better at deductive reasoning than inductive (see Object Assembly versus Block Design below). When he had to depend on inductive reasoning plus sequencing, as required by Picture Arrangement, the apparent weakness in sequencing ability may have caused the lower score.

g. Picture Completion versus Block Design: Same score.

h. Object Assembly versus Block Design: On both these subtests that measure visual-motor-spatial coordination, Cory scored above his mean, indicating a strength. The 3-point difference in favor of Block Design may indicate that Cory uses deductive reasoning (working from a whole toward unknown parts) better than inductive reasoning.

i. Coding versus Symbol Search: Coding is 4 points lower than Symbol Search. These two subtests measure visual-motor coordination and depend on attention, concentration, and short-term memory. However, Coding requires much more motor involvement. It may be that the lower score is caused by inability to use a pencil in highly speeded responses. Information about Cory's handwriting and his ability to complete written tasks on time is needed.

Exploring Other Areas of Conflict

The subtest comparisons provided information about two of the abilities in which the data were conflicting, visual perception and visualizing the whole without a model. Before we generate our final hypotheses, we need to look at the other four abilities in this category: attention, concept formation, school-acquired knowledge, and attention to details.

Attention is an ability shared by Digit Span and Picture Completion. Cory was low on Digit Span (–3) and high on Picture Completion (+3). Digit Span relies on the auditory modality and consists of nonmeaningful stimuli. Picture Completion relies on the visual modality and contains meaningful stimuli. Either of these differences could have affected Cory's scores.

Of the six subtests sharing the ability to conceptualize, Cory had a low score on only one, Picture Arrangement, and the difference was nonsignificant. On the others he scored above his mean; in two instances he scored significantly above. Since there are indications that the sequencing involved in Picture Arrangement may have affected the score on that subtest, it would appear that Cory really has a strength in concept formation.

School-acquired knowledge is based on the Information, Arithmetic, and Vocabulary subtests. Cory was low only on Arithmetic, and the difference was not significant. Because Arithmetic is the only timed test of the three, there is a possibility that the pressure of time limits had an effect. We need to know Cory's achievement level in mathematics and performance in daily work before any conclusions can be reached.

Attention to details is an ability shared by Picture Completion, Picture Arrangement, and Object Assembly. Cory scored above his mean on Picture Completion and Object Assembly but below on Picture Arrangement. Picture Completion requires only the identification of an important missing detail, and Object Assembly requires attention to details to put puzzles together. Both these subtests involve concrete tasks. Picture Arrangement presents a more complex, abstract task, involving sequencing of verbally related events (the cards must be arranged in logical order to tell a story). Cory appears to be better at attending to details when the task is simple and concrete.

Hypotheses and Recommendations

If Cory's teacher had made this analysis of his WISC-III scores, the teacher would have had much other valuable in-

formation on hand: knowledge of Cory's home background, of how he performs and behaves in the classroom, and of his specific skill deficiencies. Information from all sources should be used in generating hypotheses about strengths and weaknesses and in planning remedial work. If the information from the WISC–III conflicts with the teacher's observations, greater weight should be given to the latter. We must always remember that standardized test scores are only samples of behavior at one point in time under fixed conditions. In any case, our conclusions should be tentative, subject to confirmation, modification, or rejection as further information is gained from additional testing and work with the student.

Hypothesis 1. Cory has well developed verbal skills. He should be told that he has the ability to learn to read well. In the meantime the teacher can capitalize on Cory's strengths in abstract thinking, conceptualization, and long-term memory by asking him to watch a film, filmstrip, or television program in an area of interest and to report to the class. He can thus acquire information and share it at a conceptual level far above that of the material he is presently able to read.

Hypothesis 2. Cory appears to have difficulty with attention and concentration. First, rule out any physical factors by checking auditory acuity, visual acuity (particularly at near point), and general physical condition, especially susceptibility to fatigue. Kaufman (1994) recommends the following strategies that teachers may use in the classroom.

a. Pair Cory with a peer tutor who will model appropriate reading techniques and help him stay on task.

b. Select instructional materials that Cory can read easily and on topics of interest to him. For example, reading assignments could include reading the directions of a new game so that he could tell others how to play it, reading an article about a star athlete, or reading the instructions for assembling a model airplane.

c. Use tangible rewards (classroom privileges, free time) and intangible rewards (smiles, praise) when on-task behavior is demonstrated.

d. Try to provide a work space for Cory that will remove, or at least reduce, distracting stimuli (use partitions, cubicles, screens, and quiet corners).

e. Highlight or circle important information on assigned work papers (directions for a task, item numbers to be completed) to develop in Cory the habit of looking for certain information before he begins to work.

f. Assign work on remedial activites when the rest of the class is working on similar work projects, not during enjoyable activity time.

g. Use advance organizers that relate Cory's prior knowledge to the present task. Prereading questions to be answered or student-generated predictions to be confirmed help to focus attention and concentration.

h. Assign short selections to be read silently, followed by discussion of the meaning of the material.

Hypothesis 3. Cory appears to have a problem with auditory and visual sequencing. The following activities could be used.

a. (Auditory) Decode Morse code messages on a telegraph key made from a dry cell.

b. (Auditory) Carry out a series of oral directions. "Please go to Ms. White's room with this message, then go to the office to get registration forms, and then go to the cafeteria for a copy of today's menu."

c. (Auditory) Repeat tongue twisters.

d. (Visual) Compete with a partner to recognize sequences of unrelated letters or numbers flashed by a tachistoscopic device.

e. (Visual) Compete with a partner to correctly sequence scrambled words to form a sentence, scrambled comic strip frames to tell a joke, or scrambled paragraphs to form a story.

f. (Visual) Construct a graphic or pictorial story map to show the main events in a story the student has read.

g. (Visual) Work with sequence stories made from cartoon strips that have been cut apart. First, ask Cory to look at the frames displayed in random order and ask him to suggest a title for the story. Then have Cory identify the beginning frame and the ending frame to help him visualize the whole. Finally, he places the middle sections and explains the story as follows: "The first section tells me the problem; the last picture tells me the solution because of what happened in the middle sections" (Banas, 1993, p. 27). This technique would use Cory's strong verbal skills and his ability to reason deductively to understand why the frames must be sequenced in a certain way.

Hypothesis 4. Cory showed a weakness in short-term memory. The following activities may be helpful.

a. Play the game of "Concentration." The game can be constructed to emphasize words to be learned. Words are written twice on 3" × 3" cards, which are then cut apart. The cards are shuffled and placed face down in rows of five each. Each player turns over one card, says the word on it, and tries to turn over a card with the same word. If the player makes a pair, she or he keeps it; if not, both cards are turned down again and the next player has a turn. Short-term memory helps the players remember the position of words that are turned over but do not match at that time.

b. Play the game of "Lineup." Cory is sent from the classroom while the teacher lines up five students in front of the room. Cory returns and has 30 seconds to memorize the lineup before leaving the room again. The lineup students sit down, and Cory returns to announce the names of those students. If he

is successful, he gets to choose the students for the next round.

c. Play guessing games involving description of a person, place, or thing.

d. Teach techniques of verbal rehearsal to aid short-term memory (repeat a telephone number until the number is dialed or written down).

e. Teach mnemonic devices such as meaningful acronyms (HOMES to remember the names of the Great Lakes) or establishing categories to remember related terms.

f. Follow a predictable routine in classroom directions and formats to reduce the memory load.

Hypothesis 5. Cory performed poorly on school-like tasks and may dislike them. It is natural to dislike tasks at which we have not been successful. Tutoring a younger student in reading and arithmetic would enable Cory to demonstrate his knowledge, to increase his self-esteem, and to practice with easy materials.

There are other hypotheses that could have been generated from the foregoing analysis; these five seemed to be major ones for which there was support in the data. Further suggestions for remediation procedures applicable to specific WISC-III subtest deficiencies may be found in Banas (1995). There are also many commercial reading materials that provide activities similar to those suggested.

Summary

It is hoped that teachers will adapt these analysis procedures to their own purposes and perhaps develop other procedures as they become more familiar with the abilities involved in the WISC-III tasks. Here are some final reminders:

- Don't think of the IQ as some mystical number to be entered forever on the student's cumulative record.
- Do remember that the WISC-III, although one of the best IQ test instruments available, is still imperfect and

measures only a small part of what constitutes human intelligence.

- Don't forget that it is a waste of time and money to have the WISC–III administered if the results are not used or are misused.
- Do become familiar with the behaviors sampled by the WISC–III and the abilities necessary to perform the tasks successfully.
- Don't be satisfied with reports only of the Full Scale and Verbal and Performance IQs.
- Do insist on a report of the subtest scaled scores; look for highs and lows of a student's performance.
- Don't make the mistake of thinking that the WISC–III will tell you everything you need to know about the student's learning abilities; use information from all available sources.
- Do carry out further informal testing as you work with the student in order to determine more specifically where the deficiencies lie.

CHAPTER 5

Research: WISC, WISC-R, WISC-III, and Reading/ Learning Disabilities

Ever since the publication of the first Wechsler scale, there has been the hope that a qualitative analysis (for example, looking at differences between Verbal and Performance Scales and between subtests) would reveal patterns that would enable clinicians to classify those examined into definite categories for diagnostic purposes. This hope has not been realized by researchers in the field (Sattler, 1988). Although the tests do yield much valuable information about an individual's cognitive abilities, they cannot be used alone for purposes of classification. This is especially true in the area of reading/learning disabilities. Although many studies have shown that groups of disabled readers and learners have characteristic patterns of scores, attempts to identify the individual disabled learner on the basis of these patterns have repeatedly failed. This has led many investigators to suggest that the value of qualitative analysis lies not in its possibilities for classification or categorization, but in the fact that such analysis provides clues for generating hypotheses about the strengths and weaknesses of the specific individual tested. These hypotheses must then be checked against other information about the examinee before recommendations can be made regarding necessary intervention (Kaufman, 1979, 1994; Sattler, 1988). Investigators have consistently called for research to substantiate that certain methods of intervention (or remediation in the educational setting) are successful with individuals who have ex-

hibited certain weaknesses. Unfortunately, this research has not been forthcoming.

The point of view expressed in this monograph is that analysis of WISC–III scores is valuable for the insights it may reveal about individual students. The review of the literature in this chapter provides the rationale for this viewpoint under the major headings of Verbal and Performance Scale Differences and Subtest Patterns. Support from factor analytic studies as to what the scales and subtests purport to measure is presented, as well as the characteristic scores of groups of students with reading/learning disabilities.

The term reading/learning disability was used in the second and third versions of this monograph (rather than "reading disability" as in the original version) for good reason. Much of the research with the WISC–R and special populations was done in the field of specific learning disabilities (SLD), and the WISC–III manual (Wechsler, 1991) treats reading disability as a subset of learning disability. Artley (1980) proposed that reading and learning disabled mean the same thing. "A child having difficulty in learning to read or with some facet of language learning has a school learning disability–hence, is learning disabled. In the same way, because learning disabilities are manifest chiefly in reading or language areas, the same child could be said to have a reading problem" (p. 119). Although it is clear that reading disabled equals learning disabled, given the importance of reading ability in the present school curricula, it is not clear that learning disabled necessarily equals reading disabled. Authorities in the field of learning disabilities are still not in agreement as to a definition acceptable to all (see feature section, "LD Definition," *Journal of Learning Disabilities*, January 1985; and Hammill, 1990). This lack of agreement is reflected in practice. In a study aimed at describing the characteristics of school-aged children whom educators had identified as learning disabled, Shepard, Smith, and Vojir (1983) reported that less than one half of a very large sample (N=800) exhibited characteristics consistent with definitions of learning disabilities in federal regulations and the professional literature.

Because of the ambiguity in SLD definition, the following selective review of the literature is not restricted to only those studies investigating characteristics of disabled readers. When studies of learning-disabled children found WISC, WISC-R, and WISC-III patterns similar to those identified for disabled readers, those studies were included as well.

Verbal and Performance Scale Differences

Wechsler believed that intelligence was a global entity. He organized his tests into Verbal and Performance Scales, not because he thought they measured different kinds of intelligence, but because he hypothesized that "either through habit, training, or endowment some individuals are able to deal better with objects than with words" (Wechsler, 1958, p. 139) and that "the dichotomy is primarily a way of identifying two principal modes by which human abilities express themselves" (Wechsler, 1974, p. 9). Factor analytic studies of the WISC, WISC-R, and WISC-III have subsequently confirmed the validity of Wechsler's dichotomy.

Factor Analytic Studies

WISC. Cohen's (1959) landmark factor analytic study of the 1949 WISC standardization data at three age levels identified five factors: Verbal Comprehension 1 and 2, Perceptual Organization, Freedom from Distractibility, and a quasispecific factor. The two verbal comprehension factors were comprised of the five required Verbal subtests. Cohen noted that the distinction between these two factors was not sharp because there were substantial correlations between them. Three of the Performance Scale subtests loaded on the Perceptual Organization factor, the other two on the quasispecific factor. Cohen offered no psychological interpretation for the latter factor. The Freedom from Distractibility factor was composed primarily of Arithmetic and Digit Span. Silverstein (1969) reanalyzed the same data used by Cohen, using different factoring techniques, and concluded that there were only two meaningful factors, represented by the Verbal and Performance Scales.

WISC-R. After the publication of the WISC-R, Kaufman (1975) used the computer technology then available and factor analyzed the standardization data at all 11 age levels. He found three factors similar to those found for the WISC, but they lent more empirical support to Wechsler's dichotomy. Kaufman's factors were Verbal Comprehension (all required Verbal tests except Arithmetic), Perceptual Organization (all required Performance tests except Coding), and Freedom from Distractibility (Arithmetic, Digit Span and Coding). Thus, on the WISC-R the required Verbal subtests without Arithmetic and the Performance subtests without Coding provided very good estimates of the individual's Verbal Comprehension and Perceptual Organization abilities. Based on Kaufman's work (1975, 1979), Sattler (1988) proposed the following interpretation of the psychological dimensions of these two factors.

> The Verbal Comprehension factor score measures verbal knowledge and understanding obtained informally and through formal education. It reflects the application of verbal skills to new situations. The Perceptual Organization factor, a nonverbal score, reflects the ability to interpret and organize visually perceived material while working against a time limit. (p. 150)

The third factor, Freedom from Distractibility, is more difficult to interpret. It is composed of the Arithmetic subtest from the Verbal Scale, the Coding subtest from the Performance Scale, and the supplementary Verbal subtest, Digit Span. Its name indicates that it is a measure of an individual's ability to attend and concentrate. However, it may also measure numerical ability, because numbers are involved in all three subtests. Short-term memory and sequencing ability may be important components of this factor as well (Kaufman, 1975, 1979; Sattler, 1988).

Kaufman (1981) maintained that every factor analytic study of the WISC-R had supported the construct validity of the Verbal and Performance Scales. In a number of studies by different investigators, the Verbal Comprehension and Perceptual Organization factors emerged for each age group in the standardization data, for different races and cultural groups, for both sexes, and for a variety of exceptional populations (see

Kaufman, 1981, for citation of the specific studies). The emergence of the third factor was less consistent, and some investigators found more than three factors (Wallbrown & Blaha, 1979). However, factor analysis is not a completely objective procedure. Even though it involves the use of statistical techniques, it is influenced by the theoretical viewpoint of the researcher and the choice of statistical methods (Matarazzo, 1972). Given this, there appeared to be ample cumulative evidence to support the interpretation of the three factors found on the WISC-R by Kaufman (1975).

WISC-III. Factor analytic studies of the WISC-III were conducted on the standardization sample of 2,200 children by the test developers and published in the test manual. The results of numerous factor analytic methods converged to support the existence of four factors. The first two factors, Verbal Comprehension and Perceptual Organization, were identical to those found by Kaufman (1975) for the WISC-R. The third factor, Freedom from Distractibility, was slightly different because it consisted of only two subtests, Arithmetic and Digit Span. Coding, which was part of the third factor on the WISC-R, loaded on the fourth factor of the WISC-III along with the new subtest, Symbol Search. This fourth factor was named the Processing Speed factor (Wechsler, 1991, p. 187). According to Kaufman (1994), the first two factors are in the cognitive domain, the third is in the behavioral or affective domain, and the fourth has components of both domains in that "processing" implies cognition, and "speed" involves both behavior and cognition. Kaufman (1994) further characterizes the third factor, Freedom from Distractibility, as being within the verbal domain and dependent on auditory memory and sequential processing, and the fourth factor, Processing Speed, as being in the nonverbal domain and dependent on visual memory and response speed.

The four factors were confirmed in factor analyses of a large nationally representative sample (N=1,118) that was independent of the standardization sample but spanned the same age levels (Roid, Prifitera, & Weiss, 1993). The same four factors were confirmed in a sample of 167 children with learning disabilities, reading disorders, or attention-deficit disorders

(Wechsler, 1991); in a sample of 78 special education and at-risk children (Hishinuma & Yamakawa, 1993); and in a small sample of 21 children with learning disabilities (Roid, Prifitera, & Weiss, 1993).

The WISC-III manual provides for the calculation of factor-based index scores. Like the IQ scales, these factor-based scales have a mean of 100 and a standard deviation of 15 and may be reported on the front of the test booklet (see Appendix A). There is one drawback concerning the third and fourth indexes; each is based on one required test and one supplementary test. To save time the supplementary tests are often not administered, thus precluding the calculation of those indexes.

As further research is conducted on the WISC-III factor structure, the third and fourth factors may prove to be of particular interest in the interpretation of the WISC-III scores of students with reading/learning disabilities. They contain three of the subtests (Arithmetic, Digit Span, and Coding) on which groups of these students have consistently made low scores on the WISC and WISC-R and the new subtest, Symbol Search, which is substantially correlated with Coding.

Interpreting Verbal and Performance Scale Differences

Wechsler (1974) suggested that a difference between WISC-R Verbal and Performance Scale IQs of 15 or more points (significance at or beyond the .01 level) should be investigated. Kaufman (1979) considered a 12-point difference (significance at the .05 level) worthy of attention because it offered the clinician more flexibility in generating hypotheses as to possible underlying causes. On the WISC-III a difference of 11 or more points is significant at the .05 level (Kaufman, 1994). The 11-point difference was recommended in Chapter 4 as a starting point for the teacher's detective work. In addition to the consideration of input-output processes and modalities involved in the two scales (as suggested in Chapter 4), other interpretations for large Verbal and Performance Scale differences have been suggested (Kaufman, 1979, 1994).

1. Socioeconomic level and level of parent education may be factors. Analyses of the WISC and WISC-R standardization

data indicated that children from professional families tended to score higher on the Verbal Scale, and children of unskilled workers scored higher on the Performance Scale. Instead of socioeconomic level, data on level of parent education were collected for the WISC-III. Children of parents with less than a high school education scored higher on Performance.

2. Hispanic, Native American, and black dialect speaking children may have depressed Verbal Scale IQs.

3. The inability to work well under time pressure may depress Performance Scale IQs, because all the subtests are timed.

4. Children with reading/learning disabilities in the intermediate grades and beyond may have depressed Verbal Scale IQs because of the cumulative effect of their inability to acquire facts and skills in the school setting.

Verbal and Performance Scale differences should never be interpreted without an accompanying analysis of the subtests within each scale. The summative procedures involved in the computation of the Verbal and Performance IQs may mask significant intrascale subtest differences that make Verbal and Performance Scale discrepancies meaningless for interpretive purposes (Kaufman, 1994).

Subtest Patterns

Subtest patterns on the Wechsler Intelligence Scale for Children have been of interest to researchers and clinicians since its publication in 1949. In the 25 years between the publication of the WISC and the WISC-R, profile analysis, looking for high and low scores on individual subtests, was the technique most used in studies involving disabled readers and learners. This body of research on the WISC is summarized by referring to several reviews of the literature. Research on the WISC-R subtest patterns was primarily in terms of comparisons among Bannatyne's categories (1968, 1971, 1974). These studies are discussed individually. Finally, the few reading- and learning-related studies that have appeared since the publication of the WISC-III in 1991 are reviewed.

WISC Subtest Patterns

Huelsman (1970) reviewed 20 studies of the WISC subtest scores of disabled readers, spanning the years 1952 to 1967. Of these studies, he found that 100% reported low Arithmetic subtest scores, 95% reported low Coding scores, 80% reported low Information scores, and 60% reported low Digit Span scores. He labeled this pattern the "WISC syndrome for disabled readers." In his own study, Huelsman found the same pattern but was unable to use it to identify individual poor readers. He suggested that one reason for this failure might be the existence of subgroups of disabled readers; the studies he reviewed had treated disabled readers as if they were all of one type. He recommended that the low subtest scores of each disabled reader should be considered individually in order to generate hypotheses with regard to needed remediation.

In an unpublished dissertation, Searls (1972) reviewed 33 WISC and reading disability studies, covering the years 1952 to 1970. She reported percentages of similar magnitude to Huelsman's. Arithmetic was low in 91% of the studies, Coding in 76%, Information in 63%, Digit Span in 62%. In spite of differences among the studies in procedure, design, size of sample, and characteristics of the sample (age, grade level, sex, bilingualism, socioeconomic level, and degree of reading retardation), Searls concluded that the WISC disabled-reader syndrome was well established in the literature.

Rugel's (1974) research comparing results from 25 WISC studies was important for several reasons. It appeared the same year as the WISC-R was published, thus providing an update of WISC studies before researchers turned their attention to the WISC-R. Instead of tabulating high and low scores found in the studies, Rugel compared the scores when grouped into Bannatyne's categories. He recommended a change in the subtest membership of the Sequential category that Bannatyne (1974) later acknowledged. Rugel's research apparently provided the impetus for many subsequent WISC-R studies using Bannatyne's categories.

Bannatyne's categories (1968) were first published in an article on the diagnosis of learning disabilities in the then new

Journal of Learning Disabilities. Based on his clinical experiences, he proposed that the following groups of subtests had more psychological meaning than the Verbal and Performance Scales.

1. Spatial category: Picture Completion, Block Design, Object Assembly.

2. Conceptual category: Comprehension, Similarities, Vocabulary.

3. Sequential category: Digit Span, Picture Arrangement, Coding. (In 1974 Picture Arrangement was replaced with Arithmetic as explained below.)

Bannatyne suggested that comparisons of scores in these three categories provided much more information as to a child's deficit areas. He found in his work that genetic dyslexic children had higher Spatial scores (sum of the scaled scores for each subtest in the category) and lower Sequential scores, with the Conceptual scores falling in the middle. He defined genetic dyslexia as a "term used to describe those persons (almost always male) who exhibit a syndrome of specific linguistic skill disabilities which restrict their ability to learn to read, spell, and write as well as their full scale intelligence would indicate.... The condition is inherited" (Bannatyne, 1968, pp. 247–248).

In 1971 Bannatyne added a fourth category, Acquired Knowledge (scores on the Information, Arithmetic, and Vocabulary subtests), and gave his interpretation of the abilities involved in each category. The Spatial group required the ability to manipulate objects in space without sequencing. The Conceptual category required the manipulation of verbal concepts; because genetic dyslexics could accomplish this by using their superior visual-spatial ability, they could have some success with these subtests. The Sequential category required the ability to hold sequences of auditory and visual stimuli in short-term memory. The Acquired Knowledge category represented the child's ability to learn in the school situation.

Bannatyne's categories were based on research findings in the literature and his own clinical work. Rugel (1974) apparently conducted the first large-scale study to justify the categorization of the WISC subtests into Bannatyne's groups. From a review of 25 published and unpublished WISC studies with disabled readers, Rugel located 22 populations for which the

subtest scores could be recategorized. In spite of the fact that these populations were probably heterogeneous as to the type of disabled reader included, Rugel confirmed the pattern Bannatyne had found for genetic dyslexics—Spatial > Conceptual > Sequential. There were 13 populations for which scores of normal readers were available. The ranking for them was Conceptual > Spatial > Sequential, but this did not occur often enough to reach statistical significance. When individual subtest scores of disabled and normal readers in 11 populations were compared, disabled readers scored significantly lower on the same four subtests found by other investigators—Arithmetic, Coding, Information, and Digit Span. These subtests came to be known as the ACID group, an acronym credited to Swartz (1974).

Rugel attributed the disabled readers' low Sequential category rank to deficits in attentional and short-term memory processes. Based on a review of the factor analytic studies of the WISC and his own findings, Rugel noted that Picture Arrangement appeared to be misplaced in the Sequential category and recommended replacing it with Arithmetic, a substitution with which Bannatyne (1974) later concurred.

Thus, by the time the WISC-R was published in 1974, the ACID profile for disabled readers on the WISC was generally accepted due to the cumulative evidence from numerous studies conducted over a period of 25 years. The interested reader may locate the individual studies by referring to the references given by Huelsman (1970), Searls (1972), and Rugel (1974). There is, of course, a great deal of overlap among these references, and Searls' dissertation is unpublished. She cited seven studies not reviewed by Huelsman or Rugel: Karlsen (1953), Robeck (1964), Frommelt (1964), Lerand (1966), McGraw (1966), Bean (1968), and Rainwater (1968). Three other studies not in the three reviews are Levine and Fuller (1972), Bush and Mattson (1973), and Fuller and Friedrich (1974–1975). By adding these 10 studies to those listed by Huelsman and Rugel and eliminating the overlap between their references, the reader will have a comprehensive list of the research on the subtest patterns of disabled readers on the WISC.

WISC-R Subtest Patterns

With the publication of the WISC-R, researchers began investigating to determine if it yielded patterns similar to those found for disabled readers on the WISC. As a result of the WISC-R factor analytic research, investigators and clinicians had more empirical support for interpreting individual subtests and small groups of subtests. Contrary to Cohen's (1959) findings on the WISC, Kaufman (1975) found most of the WISC-R subtests had unique variances of sufficient magnitude to justify the interpretation of their particular contributions to the test battery. Further analyses by Kaufman (1979) caused him to state that the data on WISC-R subtest specificity gave clinicians "the right to make subtest-specific interpretations for all subtests except Object Assembly and (at ages $9\frac{1}{2}$ and above) Similarities" (p. 114). In spite of this, Kaufman recommended that, in the search for possible underlying causes of low subtest scores, the subtests should first be examined in groups according to their contribution to shared abilities. Only if this method failed to yield hypotheses as to the student's problems should clinicians interpret the individual subtests. Kaufman's recommendation thus may have influenced the increased use of Bannatyne's categories in the studies appearing after 1979.

In the WISC-R studies, the populations sampled were more often labeled learning disabled (LD) than reading disabled, although researchers examining both types of populations appeared to assume the presence of reading disability, judging by their references to the WISC studies of poor readers. In the following review, this difference in populations is noted, and the criteria for the LD classification (if reported) is stated. The studies are discussed in chronological order of publication.

Vance, Gaynor, and Coleman (1976) continued to use profile analysis, rather than Bannatyne's categories, in their investigation of the WISC-R subtest patterns of 58 children identified as learning disabled by the criteria of both Bateman and McCarthy. Scores on Arithmetic, Coding, and Information were significantly low. Digit Span was not administered, possibly because it only enters into computation of WISC-R IQs if used as an alternate. Vance et al. concluded that the three low scores,

similar to the pattern found for reading-disabled groups, were probably directly related to previous school experiences or attentional deficits.

In addition to looking at subtest patterns, Smith, Coleman, Dokecki, and Davis (1977a) were interested in ascertaining what proportion of a large sample (N=208) of children identified as learning disabled by the school system met the criterion of "normal" intelligence, since this criterion was the one most uniformly cited as a requisite for LD classification. They reported that 37% of the sample did not meet their normality criteria (WISC-R Full Scale IQ of at least 76 and either a Verbal or Performance IQ of at least 90). Nevertheless, they found both subgroups (one above the normality cutoff and one below) to have the same pattern of low scores: Arithmetic, Coding, and Information. Digit Span was not administered.

Smith et al. (1977b) subsequently recategorized the scores of the same LD sample in the manner suggested by Bannatyne (1974) into Spatial, Conceptual, Sequential (minus Digit Span), and Acquired Knowledge categories. The last category has not been used frequently in studies, because its use makes the categories not discrete. Two of the three subtests in the Acquired Knowledge category (Vocabulary and Arithmetic) are each included in another category (Conceptual and Sequential, respectively). For the total sample, Smith et al. found the following pattern: Spatial > Conceptual > Sequential = Acquired Knowledge. When the scores were analyzed by the level of intelligence subgroups identified in the 1977a study, only the "high" group displayed the same significantly different rankings. For the "low" group the direction of the rankings was the same, but the only significant differences were between the Spatial and each of the other categories. For a subgroup of the low group classified as educable mentally retarded, the pattern was Spatial > Sequential > Conceptual > Acquired Knowledge; however, these rankings were not significantly different.

In 1978 Smith retested 161 students from this same LD sample after 7 months to determine the stability of the WISC-R subtest profiles found in the 1977a study. The pattern of low scores on Arithmetic, Coding, and Information was replicated (Smith, 1978).

McManis, Figley, Richert, and Fabre (1978) compared the Memory for Designs, Bender-Gestalt, Trail Making Test, and WISC-R scores of average readers (n=12) and retarded readers (n=12). Profile analysis revealed low scores on Arithmetic, Coding, and Digit Span for the retarded readers when compared to the average readers. The Information subtest was also low, but the difference did not reach significance. McManis et al. concluded that their results did not support the hypothesis that minimal brain dysfunction (as inferred from visual-spatial deficits) was an underlying cause of reading disability. Rather, the "basic problem of retarded readers may lie in the area of inadequate short-term memory processes and difficulty in utilizing visual-perceptual information to guide rapid motor responses sequentially" (p. 450).

Vance, Wallbrown, and Blaha (1978) attempted to determine WISC-R profiles for 104 reading-disabled children through Q analysis, a factor analytic technique that investigates similarities among people based on their test scores. They found five meaningful profiles through this procedure, and 75% of the children could be classified into one of the profiles. The only profile resembling those found by other investigators was labeled Distractibility, characterized by low scores on Arithmetic, Information, and Digit Span. Vance et al. promised to deal with the interpretation of the cognitive processes involved in these profiles in a later report. Instead, they described the characteristics of the children exhibiting each profile in terms of their performance on other tests and in teaching situations, and they recommended remedial strategies (Wallbrown, Vance, & Blaha, 1979). Their work is of interest for two reasons: (a) They demonstrated the importance of relating WISC-R scores to a wealth of other information about the child, and (b) for four of the five groups of children, they recommended an analytic, rather than a synthetic, approach to the teaching of word attack skills.

Miller (1980a) criticized the work of Vance and his colleagues on several grounds, although he applauded their efforts to relate test results to remediation efforts. Wallbrown, Blaha, and Vance (1980) responded to Miller's attack by providing data not included in their first report; then Miller

(1980b) provided a brief rebuttal. Judging from the lack of follow-up studies based on the five profiles, this line of research does not appear to have had a major impact.

Vance and Singer (1979) recategorized the subtest scores of 98 school system verified LD children and found some support for the Spatial > Conceptual > Sequential pattern proposed by Bannatyne and confirmed by Smith et al. (1977b). However, the lack of clarity in Vance and Singer's report made it difficult to interpret their results.

Paal, Hesterly, and Wepfer (1979) compared the scores on both the WISC and WISC-R (test-retest interval of 5 to 8 months) of a sample of 40 students who had minimal brain dysfunction (MBD). Paal et al. used MBD as a synonym for specific learning disabilities and gave no criteria for the identification of these students, except to say that all were enrolled in a university "Therapeutic Day School" and had been "carefully diagnosed." Paal et al. found very similar subtest configurations on both tests, with the lowest subtest scores being Arithmetic, Coding, and Digit Span. They conjectured that Information was not low on either test because the students were attending a special school. Although they presented no data on recategorization scores, they concluded that their results supported Bannatyne's Spatial > Conceptual > Sequential pattern.

Stevenson (1980) chose to analyze WISC-R scores of 55 children referred to a university clinic "because of academic problems defined as skill deficits great enough to interfere significantly with educational progress" by using categories proposed by Witkin, Dyk, Faterson, Goodenough, and Karp (1962). Although they had different labels, these categories were identical to Bannatyne's categories (1974), except that Information was substituted for Similarities in the Conceptual category. Stevenson reported no significant differences between the Spatial and Conceptual categories for the total sample, across age levels, and across intelligence levels (below average, average, above average). However, the Sequential category (called "Attention-Concentration" by Witkin et al.) was the lowest for the total sample, for younger children, and for children of average and above average intelligence.

Three WISC-R studies using samples of reading-disabled children were reported in 1980–1981. In a British journal, Moseley (1980) proposed the analysis of three groups of subtests that were identical to Bannatyne's first three groups (1974). Moseley labeled the categories in a slightly different manner and made no reference to Bannatyne's work. A brief description of the two studies conducted by Moseley indicated no significant differences between Spatial and Conceptual categories, but both were significantly higher than the Sequential category.

Moore and Wielan (1981) analyzed subtest scores for a large sample (N=434) of children referred to a university reading clinic for suspected reading disabilities. This sample included an unspecified number of children who were subsequently diagnosed as not having a reading or learning disability. Moore and Wielan reported low scores on Arithmetic, Coding, and Digit Span (Sequential category), and on Information, Arithmetic, and Vocabulary (Acquired Knowledge category), thus supporting results from previous studies with reading disabled children.

The third reading-related study (Badian, 1981) continued the effort begun by Smith et al. (1977b) to identify WISC-R subtest category patterns for subgroups of reading and learning disabled students. Although she found the most striking and consistent difference between good and poor readers to be the much higher percentage of poor readers scoring low in the Sequential category, Badian concluded that both level of overall intelligence and chronological age affected the category pattern.

> Among poor readers of higher IQ (M=105.1), the Conceptual > Spatial > Sequential profile was almost as common as the Spatial > Conceptual > Sequential profile, and among the low IQ (M=89.6) poor readers, the Spatial > Sequential > Conceptual profile was most common. Older high-IQ poor readers were more likely to exhibit the Spatial > Conceptual > Sequential profile, and the Conceptual factor tended to be lower than the Sequential in the oldest low-IQ poor readers. (Badian, 1981, p. 114)

Three WISC-R studies using samples of learning-disabled children subsequently attempted to find distinctive subgroup

category patterns. Henry and Wittman (1981) examined the scores of 200 children. They randomly selected 40 students from each of five different special education programs: LD, full-time placement; LD, resource program; emotionally disturbed; educable mentally handicapped; and gifted. All children had been classified and assigned to these groups by school district personnel. Henry and Wittman recategorized the subtest scores according to Bannatyne's categories; the Sequential category included only Arithmetic and Coding scores because Digit Span scores were not available for all students. Henry and Wittman reported that the Spatial > Conceptual > Sequential pattern was characteristic of all groups except the gifted children. The latter exhibited a Conceptual > Spatial > Sequential pattern.

Schiff, Kaufman, and Kaufman (1981) found the same category pattern for a sample of 50 children with learning disabilities with superior intelligence (M=123) as Henry and Wittman had for their gifted group; that is, Conceptual > Spatial > Sequential. The Acquired Knowledge category was omitted from the statistical analysis because it overlapped with two other categories; however, Schiff et al. stated that scores in this category were high, averaging only slightly below the Conceptual category scores. When the subtest scores were analyzed according to Kaufman's three factors, the children performed at the 95th percentile on the four Verbal Comprehension factor subtests (Information, Similarities, Vocabulary, and Comprehension); at the 80th percentile on the Perceptual Organization factor (all Performance subtests except Coding); and at the 64th percentile on the Freedom from Distractibility factor (Arithmetic, Coding, and Digit Span). Thus, analysis by Bannatyne categories and by factor scores resulted in a very similar pattern of strengths and weaknesses for this sample of gifted LD children.

Finally, Ryckman and Elrod (1985) recategorized the WISC-R scores of 208 children identified by their school systems as having learning disabilities, looking for subgroups. They found only one subgroup (n=38) that exhibited Bannatyne's genetic dyslexic pattern. For most of the children, Conceptual scores were higher than Spatial scores. However, the Sequential category was the lowest for all subgroups identified.

Based on an inspection of 30 WISC and WISC-R studies of heterogeneous groups of children with reading/learning disabilities, Sattler (1988, p. 610) provided a rank order listing (from highest to lowest) of the average subtest scores:

1. Picture Completion
2. Picture Arrangement
3. Block Design
4. Object Assembly
5. Similarities
6. Comprehension
7. Vocabulary
8. Coding
9. Digit Span
10. Arithmetic
11. Information

This ranking confirms what is evident from the foregoing review of the research on WISC and WISC-R subtest patterns. Profile analysis revealed the four most difficult subtests (ranked 8th to 11th) to be the ACID group. Recategorization of scores, whether in terms of Bannatyne's or Witkin et al.'s categories or Kaufman's factors, consistently demonstrated that the Sequential/Attention–Concentration/Freedom from Distractibility labeled group of subtests (Arithmetic, Digit Span, and Coding) was significantly lower than the other groupings.

WISC-III Subtest Patterns

As of December 1996, a computer search of the PSYCLIT and PSYCINFO databases produced only a few studies that had been conducted with the WISC-III and children with reading/learning disabilities. This is to be expected since the test was not published until the fall of 1991, and it typically takes several years before studies begin to appear in the literature. Because of the substantial correlations between subtest and summative scores on the WISC-R and the WISC-III and because of the item overlap between the two tests, the WISC-

III manual suggests that the accumulated research with the WISC-R should continue to be considered in the generation of hypotheses, even as new studies with the WISC-III appear in the professional literature (Wechsler, 1991).

The earliest studies with the WISC-III appear in the test manual. They were conducted during the development and validation of the test in order to provide criterion-related evidence of the validity of the WISC-III for distinguishing groups of exceptional children (Wechsler, 1991). The one such study of interest to readers of this monograph was later published in greater detail, so it will be reported from that source (Prifitera & Dersh, 1993).

Prifitera and Dersh determined the occurrence of various WISC-III subtest patterns for a sample of 99 children with learning disabilities (LD), which included children with reading disorders, a sample of 65 children with attention-deficit hyperactivity disorder (ADHD), and the standardization sample of the WISC-III. The LD subjects were identified by mental health professionals based on established diagnostic criteria used in the three clinical settings from which the LD sample was selected. The ADHD sample was selected from two different clinical settings by mental health professionals based on criteria in the third edition-revised of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III-R) (American Psychiatric Association, 1987). The four lowest subtests for both clinical groups were Symbol Search, Coding, Arithmetic, and Digit Span (SCAD). The Information subtest was in the middle of the subtest rankings. Thus, the ACID pattern of lowest ranked subtests previously found on the WISC-R was replaced by the SCAD pattern in these samples. Both clinical groups showed the Bannatyne pattern previously found on the WISC-R: Spatial > Conceptual > Sequential. The Acquired Knowledge group of subtests (Information, Arithmetic, and Vocabulary) was also lower than the Spatial and Conceptual groupings in the LD sample and lower than the Spatial subtests in the ADHD sample. The occurrence of the subtest patterns that Prifitera and Dersh examined was significantly higher in the two clinical samples than in the standardization sample. The researchers were not surprised to find that the LD and ADHD

samples had very similar patterns because "many children with an attention-deficit disorder also may have a learning disability and vice versa" (Prifitera & Dersh, 1993, p. 55).

The WISC-III subtest scores of 45 ADHD children were examined by Schwean, Saklofske, Yackulic, and Quinn (1993). The subjects had to meet very specific criteria to be selected for the study. These criteria included a diagnosis of ADHD by a child psychiatrist based on the DSM-III-R, ratings above a cut-off point on a clinical measure of hyperactivity, and a Full Scale IQ of at least 75 on the Stanford-Binet Intelligence Scale. Scores on the third and fourth WISC-III factors were significantly lower (when compared to the WISC-III standardization sample) than scores on the first two factors. The third and fourth factors are based on Symbol Search, Coding, Arithmetic and Digit Span. When the subtest scores were considered individually, these four subtests were significantly lower (when compared to the standard score of 10). Thus the presence of the SCAD pattern was supported in this sample. In addition, the subjects made significantly lower scores on two other subtests, Picture Arrangement and Information; the low score on Information meant that the ACID profile was also present.

The SCAD profile also appeared in a study of 26 dyslexic children by Newby, Recht, Caldwell, and Schaefer (1993). The classification of dyslexic required average intelligence on the WISC-R; reading below average on two formal measures of reading ability; normal or corrected hearing and vision; adequate educational opportunity; and a standardized questionnaire indicating that any emotional or behavioral problems were not the primary cause of the reading problem. The third and fourth factors (based on the SCAD subtests) were significantly lower than the subjects' performance on the first and second factors. Newby et al. (1993) suggested that the fourth factor, Processing Speed, which links the new Symbol Search subtest with Coding, is of "great potential interest in a reading-disabled population because many researchers...have suggested that deficits in the speed or automaticity of lexical access are important in understanding reading disabilities" (p. 91).

Neither the ACID nor the SCAD profile was found in a group of 31 remedial (defined as learning disabled) students

who attended a private educational agency serving the gifted and the learning disabled (Hishinuma & Yamakawa, 1993). The classification of remedial was based on historical data, teacher observations, informal and formal testing, and clinical judgment by a multidisciplinary team. The subjects' lowest subtest scores were on Arithmetic, Coding, Digit Span, and Vocabulary.

Finally, a study by Ward, Ward, Hatt, Young, and Mollner (1995) supported the existence on the WISC-III of the ACID pattern but not the SCAD pattern for a group of 382 students with learning disabilities. Students were classified as learning disabled by a multidisciplinary team, using criteria established by the school district that were consistent with federal and state guidelines. The five lowest subtest scores were Digit Span, Arithmetic, Information, Vocabulary, and Coding. The mean on the Vocabulary subtest was only .41 higher than the mean on Coding, so the ACID profile was supported, with Vocabulary also low. Scores on Symbol Search were ranked third from the highest. It should be noted that scores on Symbol Search were available for only 163 subjects in the sample because this supplementary subtest was administered less frequently. Although the ACID profile was significantly more prevalent in this LD sample than in the standardization sample, the percentage of subjects displaying the SCAD profile was not significantly different from the standardization sample.

Given the limited evidence currently available, it is too early to say whether the SCAD subtests will replace the ACID subtests as the quartet of subtests on which groups of students with reading/learning disabilities most often make their lowest scores on the WISC-III. Kaufman (1994) predicts that the SCAD profile will prevail; that is, Symbol Search will replace Information as a subtest with which such students have problems. Kaufman gives several reasons for his prediction. First, Information, perhaps more than the other subtests, is item dependent. It is possible that changes in the WISC-III Information items (50% were either new or substantially modified) positively affected the performance of students with reading/learning disabilities. "A couple of WISC-R Information items that may have discriminated significantly between learning-disabled and normal children may have been inad-

vertently replaced by items that do not discriminate between these samples" (Kaufman, 1994, p. 218). Second, Information is not the first subtest administered on the WISC-III (as it was on the WISC and WISC-R). Children can begin with a game-like subtest (Picture Completion) before they are faced with a school-like subtest (Information). This reduces test anxiety, which is apt to be higher in school-referred children, and perhaps enables the subjects to access more easily the facts required by the Information subtest. Third, the untimed Information subtest calls for knowledge stored in long-term memory—knowledge that can be acquired from sources other than printed materials, especially in the 1990s when television viewing occupies increasing amounts of children's time. Conversely, Symbol Search is timed and measures a process, not content. Like the other three SCAD subtests (Coding, Arithmetic, and Digit Span), it depends heavily on the use of working memory, a "kind of middle ground between short- and long-term memory" (Kaufman, 1994, p. 223). In each of the SCAD subtests, subjects must encode information in working memory and maintain it long enough to recognize the problem that must be solved, determine how to solve it, and solve it within a time limit. Children with learning disabilities are apt to have dysfunctional working memories that impair their problem-solving abilities. It will be interesting to see if Kaufman's prediction is confirmed by future research.

Summary and Conclusions

The review of the literature demonstrates the value of analyzing intrastudent variations in WISC-III subtest scores in order to generate hypotheses as to an individual student's strengths and weaknesses. Procedures for conducting such an analysis for students with reading/learning disabilities were outlined in Chapter 4. After the first edition of this monograph was published, Kaufman (1979), a clinical psychologist, defended this method of analyzing subtest scores, particularly the rather liberal statistical criteria used to determine significant differences. (See also Kaufman, 1994, for application of his method to the WISC-III.) He recommended hypothesizing a

weakness in an ability shared by two or more subtests if only one of the subtest scores was significantly low and the other subtests sharing that ability were also below the child's own mean. He also felt it was practical "to delve into profiles to find support for various hypotheses from subtests that were not significant strengths or weaknesses, knowing that the outcome of the detective work is indeed a set of hypotheses and nothing more" (Kaufman, 1979, pp. 192–193). In other words, the worst that could happen would be that such hypotheses would have to be rejected in the face of other data about the child (from further testing, observation of classroom behavior, and information from parents). The best that could happen would be that such hypotheses would be confirmed by other data and would suggest effective remedial strategies.

It is hoped that perceptive teachers will combine their knowledge about the WISC–III from this monograph with their knowledge about individual children to provide more successful academic experiences for students with reading/learning disabilities.

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Appendix A
WISC–III Record Form

Name: Cory W. Sex: M

School: Eastway Elementary Grade: 4

Examiner: Searls Handedness: R

WISC-III

Wechsler Intelligence Scale for Children®–Third Edition

Subtests	Raw Scores	Scaled Scores																		
Picture Completion	22						13					13								
Information	15			12							12									
Coding	20					9												3		
Similarities	16		12						12											
Picture Arrangement	15						6						6							
Arithmetic	14		8													8				
Block Design	43						13					13								
Vocabulary	28		12						12											
Digit Span(S)	25					10						10								
Comprehension	22		13						13											
Symbol Search	14						7											7		
(Digit Span)	8		5												5					
(Maze)																				
Sum of Scaled Scores		57	45	49	42	13	10													
		Verbal	Perfor.	VC	PO	FD	PS													
		Full Scale Score 102		OPTIONAL																

	Year	Month	Day
Date Tested	95	10	15
Date of Birth	86	3	10
Age	9	7	5

	Score	IQ Index	%ile	90% Confidence Interval
Verbal	57	102	70	102 - 112
Performance	45	99	34	88 - 101
Full Scale	102	101	53	96 - 106
VC	49	113	81	107 - 118
PO	42	109	61	97 - 111
FD	13	81	10	76 - 91
PS	10	75	5	71 - 87

Subtest Scores

Verbal							Performance							
Inf	Sim	Ari	Voc	Com	(DS)		PC	Cd	PA	BD	Cbl	SS	Mz	
12	12	8	12	13	5		13	3	6	13	10	7		

IQ Scores / Index Scores (Optional)

VIQ	PIQ	FSIQ	VCI	POI	FDI	PSI
108	99	101	113	109	81	75

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Appendix B
WISC–III Data Sheet

Name of Subject _____ Age _____ Date _____

Examiner _____ Sex _____ Grade _____

Full Scale IQ _____ Wechsler Classification of Intelligence

Verbal IQ _____ _____

Performance IQ _____ Difference between V and P IQs _____

VERBAL SCALE	Subtest Scaled Scores	Diff. from Verbal Mean (3 pts.=sig.)
1. Information		
2. Similarities		
3. Arithmetic		
4. Vocabulary		
5. Comprehension		
6. Digit Span (Supplement)		
Sum of Verbal Tests		
Verbal Mean		

PERFORMANCE SCALE		Diff. from Perf. Mean (4 pts.=sig.)
7. Picture Completion		
8. Coding		
9. Picture Arrangement		
10. Block Design		
11. Object Assembly		
12. Symbol Search (Supplement)		
Sum of Performance Tests		
Performance Mean		

Appendix C
Abilities Measured by Two or More WISC–III Subtests

Name of Subject _____ Date _____

Abilities	Verbal Scale						Performance Scale					
	I	S	A	V	C	DS	PC	Cod	PA	BD	OA	SS
a. Vis-Perception							___		___			
b. Vis-Motor-Coor								___				___
c. Vis-Motor-Spat										___	___	
d. Attention						___	___					
e. Attn + Concen			___					___	___			___
f. Concept Form	___	___		___	___				___	___		
g. Sch-Acq Knowl	___		___	___								
h. Abst. Thought		___		___						___		
i. Sequencing						___		___	___			___
j. Sch-Like Task			___					___				___
k. Visualize Whole									___		___	
l. S-T Memory			___			___		___				___
m. L-T Memory	___	___		___	___							
n. Attn to Details							___		___		___	
o. Environ-Exper	___			___	___		___					

Note: I=Information, S=Similarities, A=Arithmetic, V=Vocabulary, C=Comprehension, DS=Digit Span, PC=Picture Completion, Cod=Coding, PA=Picture Arrangement, BD=Block Design, OA=Object Assembly, SS=Symbol Search

What is WISC-III, and how can it be used to help teachers detect reading/learning disabilities?

This monograph provides classroom teachers, reading teachers, and teachers of students with specific learning disabilities information about one of the most widely used intelligence tests: the third edition of the Wechsler Intelligence Scale for Children. It also explains the use of intelligence testing in the diagnosis of reading/learning disabilities.

In five accessible chapters, author Evelyn Searls acquaints educators with the organization and administration of the WISC-III, the tasks involved in each subtest, and what each subtest is designed to measure. She also suggests procedures for analyzing WISC-III scores in ways that may yield valuable information for the teacher as he or she seeks to remediate a student's reading/learning disability.

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ISBN 0-87207-186-5

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